The Welding Engineer
FEBRUARY, 1944
THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

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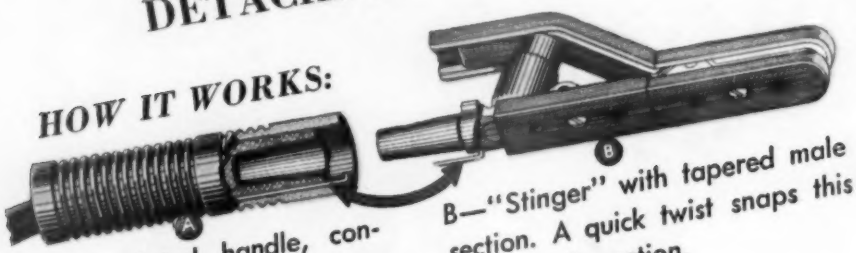
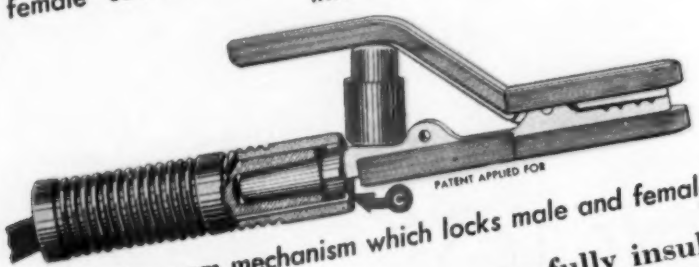


A—Insulated handle, containing female cable connector.

B—"Stinger" with tapered male section. A quick twist snaps this into female section.



C—Actuating cam mechanism which locks male and female.

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A. Good weldment.
B. Poor weldment. Note poor penetration and slag inclusions.
C. Good weldment.
D. Poor weldment. Note gas pockets.

looking inside WITH X-RAY

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

It Is Later--------

There came recently to my desk a poem which I feel should be read by all of us on the home front. The author is unknown—an unsung hero on one of our many fighting fronts. Whoever and wherever he may be, however, this soldier-poet gives us all something to think about:

When you're lying in a fox-hole with a rifle at your cheek,
Then there ain't no time for thinking of a forty-four-hour week,
For the tropic rains pour on you while your nose is in the mud
And your overtime is counted when they pay you off in blood.
You just grip your rifle tighter as you wade into the fight,
And there's no time off for gassing 'bout the date you had last night,
For you know it would be foolish, and you save your precious breath,
For the only date you're keeping is a rendezvous with death.

And you feel the fevered silence
As the sun begins to sink,
Time is short and growing shorter;
It is later than you think.

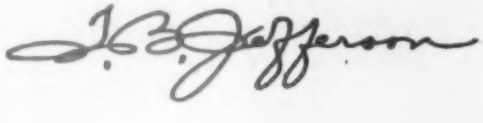
When you're home and working steady you have time to shout the bull
For your boss ain't always looking and his hands are kinda' full,
You can grouse about your wages; you can sneak out for a smoke;
You can leave the drill press idle while you hear or tell a joke;
But the pay-off's coming later for the job you haven't done,
When the fighting isn't over and the battle isn't won.
For the forge that's lying idle forges chains you cannot see
'Til you find a stricken Nation in the bonds of slavery.

And eternity will damn you
As your soul begins to shrink,
Time is short and growing shorter;
It is later than you think.

Sixteen million man-days have been lost in strikes
But you can thank God they weren't among those in the fight,
Regardless of the time of day; without a thought as to the rate of pay
We who dodge the sniper's bullets are on the job to stay.
Some are born to do the fighting, some must work and some must pray,
But there isn't one among us who can sit and rest today;
For the freedom that we cherish puts a levy on our soul,
And we may not shirk our duty 'til we reach that final goal.

For the time is growing shorter
As we near destruction's brink,
And your job needs lots of doing;
It is later than you think!

Our unknown friend has told his story well. Let it be hoped that those to whom he is speaking will take heed. Their actions will have much to do with the return of peace.



ARC WELDING HIGH LIGHTS

MUREX ELECTRODES were among the first of the "hot rods" available to the welding industry. Introduced thirteen years ago by Metal & Thermit, these heavy, all-mineral coated electrodes for downhand welding were sensational because of the high currents at which they operated and the excellent, X-ray clean weld metal they produced.

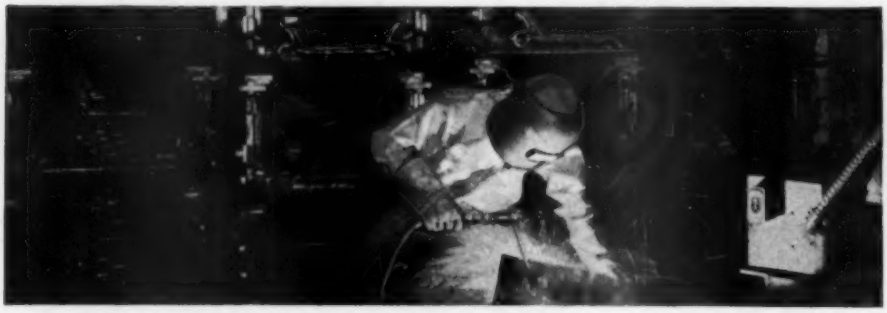
Fabricators of pressure vessels, machine frames, bases and other heavy units were quick to appreciate the advantages of electrodes of this type, and to put them to use in reducing welding costs and improving the quality of welding.

Today, concerns who were among the original users of downhand Murex Electrodes are the leading producers of war materials and are making use of the high speed welding techniques which these "hot rods" make possible to turn out tanks, gun mounts, bombs and other armaments at an unprecedented rate.

Illustrated are several typical applications—past and present—of this kind of welding.

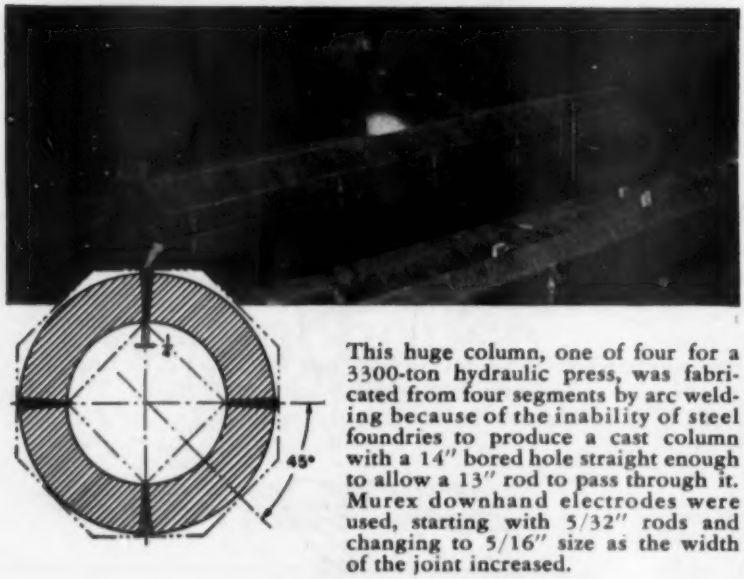
The Murex line, of course, also includes electrodes for all-position work, for use with a.c. equipment, for welding alloy steels and for hard surfacing. Write for the Murex war time catalog.

Pressure vessels, made by Black, Sivalls & Bryson Inc. of Oklahoma City, for low temperature service in the oil refining industry, are fabricated with Murex nickel steel electrodes, chosen because of their fast downhand characteristics and high physical properties. Such pressure vessels are welded as rapidly as mild steel.



In the early days of coal mining every operation was performed by human labor and animal power. Today mechanization dominates every activity. Typical of the heavy equipment, which must stand hard and constant usage, is this Goodman Shaker Conveyor. Photograph shows welding a shovel trough of a duckbill loading head with Murex Electrodes, selected because of the strength and ductility of the deposited metal.

At the plant of the Eljer Co., Salem, Ohio, men who had become skilled in making plumbing fixtures are now turning out 1000-pound bomb casings. Photograph shows arc welding first pass on upper and lower portions of an aerial bomb. The use of downhand Murex Electrodes assures X-ray clean welds of good penetration and excellent ductilities.



This huge column, one of four for a 3300-ton hydraulic press, was fabricated from four segments by arc welding because of the inability of steel foundries to produce a cast column with a 14" bored hole straight enough to allow a 13" rod to pass through it. Murex downhand electrodes were used, starting with 5/32" rods and changing to 5/16" size as the width of the joint increased.

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Specialists in welding for nearly forty years. Manufacturers of Murex Electrodes for arc welding, and of Thermit for repair and fabrication of heavy parts.

Courtesy, The Lincoln Electric Co.

Training the student to do the actual work he will perform in war industry means less lost motion, more efficient production welders. This student at California Polytechnic College, San Luis Obispo, Calif., is doing a touch-up job on an aircraft motor mount under instructor supervision.

Welding *in the* World of Tomorrow

Our editor doesn't believe in crystal gazing, but he does have a pretty definite idea as to what the post-war future of welding is going to be. New uses, new users, applications to new materials and the need to continue vocational school training programs are among the predictions he makes in this significant forecast.

By **T. B. JEFFERSON***

WHEN anyone sets himself up as one who can predict what is to happen tomorrow, he is heading for trouble. Personally, I have never had any faith in soothsayers. In your travels, you may have noticed signs along the way pointing to the homes of fortunetellers or palmists. Have you ever paid particular attention to the houses inhabited by those persons? I can assure you that they are not the places in which you and I would live if we possessed the ability to peer into the future. So instead of gazing into the crystal ball to forecast the future of welding in the world of tomorrow, I will endeavor to present a case based on opinion backed by logic.

Looking Backward

As an introduction, I would like to review a little welding history. Oxy-acetylene welding as we know it today first came into use commercially in about 1906. We had resistance welding and oxy-hydrogen welding long prior to 1906, but most of it was of an experimental nature, and it was not until the discovery of a cheap way of manufacturing carbide for the production of acetylene that oxy-acetylene welding came into practical use. The first arc-welding patents were issued in 1887, but few important applications of the process had been made before 1912. By the time of World War I, important advances had been made in both arc and gas welding. Gas welding, in particular, was of considerable importance in salvage operations during that war.

After the armistice, welding was used primarily as a maintenance tool and as a means of joining lengths of pipe in cross-country pipe lines. This continued to be the status of welding until about ten years ago. Much credit can be given to the oldtime weldor for holding back the extended use of welding. During the early days of welding, the weldor acted very much like a haughty prima donna. He was able to assume this untouchable position largely because he knew more about what he was doing than anyone else. The knowledge of the general public was limited regarding what could be and what could not be done by welding, and so the final decision was left to the weldor. His answers sometimes depended on whims but his decisions, true or not, were always law, and no one thought of appealing to a higher court. This condition existed for years and was still some-

* From a paper presented at the 37th annual convention of the American Vocational Association, Chicago, December 17, 1943.

what prevalent in the welding field even as late as Pearl Harbor.

Welding in World War II

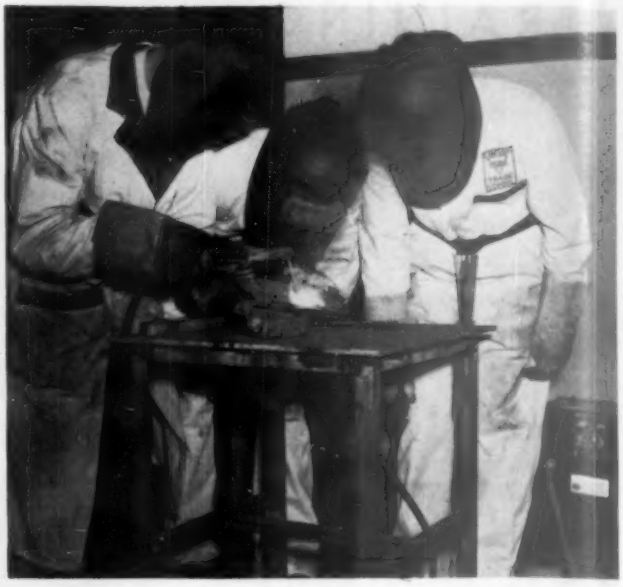
The war situation gave welding a tremendous boost. Overnight, America became the arsenal of democracy. It was our job to produce planes, tanks, guns, ships and other items of armament in heretofore undreamed of quantities. Welding is the ideal way of joining metals hurriedly while at the same time providing high strength and conserving material. Because these advantages are unquestionable, the welding industry grew more than 300% between 1940 and 1942.

This tremendous increase in the use of welding naturally presented personnel problems. There was an inadequate supply of weldors; thus the users of welding were forced to turn to various privately established schools as suppliers of trained personnel and operate their own training schools as well. It was because of this that the oldtime weldor lost his grip.

Greenhorns had been trained to weld but not trained in the limitations of welding and were willing to try to weld anything placed before them. Hence, engineers instead of weldors began to determine what could be accomplished by welding, and purchasing agents began to select the welding equipment used. As a result of this trend, welding became even more useful to the war production program, and each short cut developed for greater production led to its still more widespread adoption.

Schools—Good and Gyp

The increased demand for trained weldors led to the establishment of many welding schools. Some of these schools were established, apparently, for no other purpose than the taking away of the student's money. There were all too many such gyp schools. For two, three or five hundred dollars, depending upon what the traffic would bear, they would offer "courses" in welding and after a period of time pass the student out as a "certified" weldor. Some instruction was given, of course, but as a rule these schools were operated under such crowded conditions that the student actually received very little practical training in the trade. Consequently, when he reached his place of employment he was not a trained weldor as he thought himself to be but merely a helper or tacker.



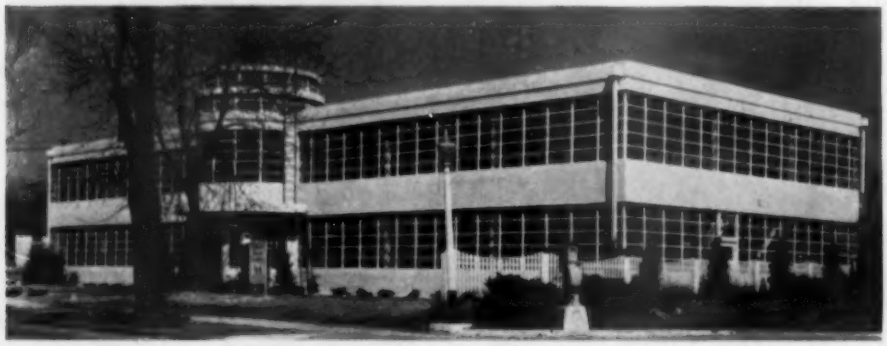
Among vocational schools which have been doing a conscientious job of training weldors for war work is the Lawson Y.M.C.A. Trade School, Chicago. On completing the welding course, each graduate has had 90 hours of electric and 90 hours of gas welding.

Courtesy, General Electric Co.

Other Training Sources

After these discouraging experiences, manufacturers began to look to other sources for their trained weldors. In some instances, they set up their own training schools. In others, they resorted to Government sponsored schools or to the vocational schools in the community. Here again trouble was experienced. In some instances, Government schools had become more or less boon-doggling institutions where students built trinkets rather than gained practical experience. Many vocational schools were really doing a conscientious job of training weldors, but even in such schools there was often a lack of understanding of the particular problems at hand. Frequently, students would be given extensive training that bore no relation to the particular jobs on which they were to go to work. Ship weldors, for example, might be trained to do a beautiful job of welding on light gauge metal tubes. Though academically sound, such training was of little value from a practical standpoint, and the student was more or less lost when he arrived on the job and had to be trained all over.

After considerable lost motion, it seemed wise to seek counsel regarding these weldor training programs so the Office of Education came into the picture. This organization, through the War Vocational Training Program, was able to assist in the development of a program designed to meet the needs of the organizations requesting weldors. Consequently, the welding training program is now functioning quite smoothly and most employers (particularly when they make their wants known) are receiving trainees who are proving satisfactory on the job. This brings us up-to-date, but what does the future hold?



Courtesy, Hobart Brothers.

Built entirely of arc-welded steel and glass, the Hobart Trade School Inc., Troy, O., is a concrete example of the modern fabrication methods being taught inside. The main course of study consists of 160 hours of training in the metal-arc welding of steel. Additional special courses are provided in the welding of alloys and non-ferrous metals.

New Uses for Old Metals

My first prediction is that the problems of the future in welding will probably be as diversified as those in the past. We are living in a metal age and when the war is over will realize it even more thoroughly than

Some manufacturers have found it necessary to set up their own welder training schools. This group of women welding students is being taught the technique of atomic-hydrogen arc welding at the Propeller Division of Curtiss-Wright Corp.

Courtesy, General Electric Co.

we have in the past. The capacity of our steel plants has been upped considerably during the war, and new uses must be found. Furthermore, the light metals, aluminum and magnesium, have been developed to such an extent that many applications will be found for them in postwar products. Not only has the production of light metals increased many fold, but there has been a similar increase in our knowledge of working them. Magnesium, for example, was for years regarded as a highly inflammable material. Now it can be readily welded by arc, by gas and by resistance welding processes. In fact, as a result of recent developments, the welding of magnesium is no more difficult than aluminum welding.

Glass and Plastics

Undoubtedly, we may also look for the use of welding in the plastic and glass fields. The metallic substances will be welded by the arc, gas or resistance welding processes as they are now commonly employed. The non-metallic materials will probably be welded by gas welding or by processes employing high frequency induction heat or other forms of heat that may be used with non-conductive materials. The statement that glass and plastic materials may be welded probably seems far fetched, but many of you, perhaps, have already welded glass, though you didn't call it welding. Think back to school days, to the chemistry lab where glass tubing was used extensively to build the apparatus required for various chemical experiments. If the tubing at hand was too short, how was it lengthened? As I remember, we used to do it by taking another piece of glass tubing and holding the two pieces in the flame of a Bunsen burner until the ends had become plastic. The ends were then placed lightly together and allowed to become one. A welded glass joint, indeed!

Postwar Welding Users

Who will use welding after the war? This question is one commonly asked because its answer will give a clue with regard to another question: who will be the employers of weldors after the war? Most probably, there will be three types of users of welding in our postwar world: former users, expanded users and new users.

Naturally, those who have used welding before the war will continue to use it afterwards. The big users in this category include shipbuilders, builders of tanks (pressure vessels), pipe line and structural steel contractors and a miscellaneous group of manufacturers of steel products.

The second classification will include those who used welding in a small way before the war, but will greatly expand its use in the postwar world. These are the manufacturers of motor cars, airplanes, agricultural implements and the like.

The third group will be comprised of organizations whose products before the war did not include the use of welding. Through war contracts, such manufacturers have been introduced to welding and have learned of the many advantages presented by this superior method of metal fabrication. Naturally, they will be inclined to favor this advantageous method in the postwar world. Since they will, moreover, have the equipment at hand with which to do welding readily, there is no reason at all why they should revert to the slower, more costly methods of fabrication previously used in their plants. Organizations that will be included in this group are manufacturers of stoves, furniture, household appliances, office equipment, steel shelving, shop equipment and the like.

Inasmuch as there will be many users of welding—both old and new—after the war, the welding future looks bright. The next question, undoubtedly, will be what are the prospects of vocational training after the war?

Too Many Weldors?

When the war is over, there will probably be about 600,000 weldors in this country. This figure represents an increase of probably 300% over the number of weldors before the war. Though it is improbable that the immediate postwar uses of welding will require such a large number of weldors, I do not believe there will be a surplus because:

(1) It is estimated about 25% of the total number of weldors today are women. A large majority, probably as much as 80% of all the women employed as weldors today, will return to homemaking or to other more feminine peacetime occupations. This will account for 20% of the total number.

(2) Another 20% of the total is comprised of persons who lost their old jobs as a result of the war and so were forced into welding. Most of this group will probably return to their previous types of employment. Old age and the terrific pace of wartime work will undoubtedly wash out some more.

(3) Another 20% of the present day weldors will probably be considered unfit for further work in the trade because of a different employment set-up in the post-war world. These weldors will find it necessary to take further training in order to obtain work. In some instances, this

A well-rounded training program should lay emphasis upon the development of weldors able to use both torch and arc and to work with all materials on all types of joints.

condition will exist because the weldor was not properly trained in the beginning. In other instances, it will be because he became too mechanized in the war production program; that is, instead of broadening into an all around weldor he specialized. It is possible that during the war period he did only one job—weld 12 in. up on bulkhead 13. This condition exists extensively in our defense plants today. Consequently, there are many, many weldors who are unable to do all-around welding, all-position welding or weld on different materials.

This unfortunate situation may be blamed partly on the employer and partly on the weldor himself. Present production demands make it advisable to use an assembly-line method of production. A weldor, therefore, is frequently employed to do one specific job only. Lacking initiative, he is satisfied, and his job soon becomes a more or less automatic operation. This lack of initiative means that he does not desire to move about throughout the plant so that he will gain the variety of experience necessary to be classified as an all-around weldor. Often, however, the employment setup is such that even if he does have the initiative he is not free to vary his job. In either case the result is the same—specialized experience.

Schools of the Future

I estimate that probably 33% of the weldors who will be employed in the postwar world will need further schooling in order to handle their jobs in the future. Remember, though, the fact that they need training does not necessarily mean they will seek it. Many of them will seek it, however, and on top of this there will naturally be the needed replacement group, which will continue to occupy the time of our vocational schools for years to come.

Welding will undoubtedly be a must course in the vocational schools of the future. It should be a part of every shop training program. Just as in the past we have taught the student forging and blacksmithing or machine work so in the future we shall include welding as an indispensable part of the curricula.

Welding courses should be open to girls. There are many jobs and will be many jobs in the future which can be handled satisfactorily by girls and women. Much of the welding which will be done on the airplanes of the future will be work of this classification.

Our schools of the future will undoubtedly have more extensive automotive shops and aircraft shops. In either of these shops, welding should naturally play an important part of the training program. Vocational schools in the rural areas will find welding in great demand, for the process can be used so extensively in the repair and hard-facing of farm machinery that it is possible that welding equipment will be part of the shop equipment on many postwar farms. It is only natural, therefore, that the farm boy should be properly trained to do a satisfactory job of welding in connection with his agricultural activities.

More Practical Programs

As to how the weldors of the future will be trained, to me it seems that vocational schools should determine more definitely what was expected of the trainee, what he should know, what he should be able to do and how he should do it. I realize that vocational leaders in the past have made repeated efforts to determine the requirements of industry and have received replies which were often contradictory, confusing and for the most part meaningless. Possibly, this condition is because the vocational leaders sought counsel from the wrong men. Perhaps the men they looked to for advice were too far away from the production end of the business. Maybe the persons consulted were entirely unfamiliar with the processing requirements of their company because of their executive connections. This is often the case when answers are sought from personnel men.

Perhaps it might be a good plan for vocational schools to keep closer tabs on their graduates, those who have taken their training and have gone out to battle the problems of the world. The youngster who has met rebuff will be in a position to specify accurately the deficiencies and superfluities of his vocational training program. A frequent criticism of vocational school trainees in the welding field has been that they have had too much theory and not sufficient practice. This point should be studied thoroughly in setting up postwar training programs for weldors.

The postwar weldor must have both theory and practice. He should have a thorough understanding of the welding job he is to do as well as a good understanding of metallurgical and other problems (such as contraction, expansion, etc.) so that he will be able to perform satisfactorily any job placed before him.

In closing, I would like to emphasize two points. First, that there will be a definite need for the training of weldors in the immediate postwar world to take care of the expanded uses of welding in peacetime production. As to whether this training program will be in the vocational schools, a continuation of high school vocational training, through plant in-training programs or through an apprentice system, I am not in a position to say. It will probably be a combination of all of these methods, but training there must be.

Future Trainee Qualifications

Secondly, the trainee weldor of the future must be different from the trainee of the past. His training must be such that he will have an adequate understanding of welding, its principles and their applications, an understanding of metallurgy, of electricity, of the gases used in welding and cutting, of fluxes and of the other factors which go to make welding a composite trade, combining the knowledge of many other trades.

The order is big, but when the job is done we should have a trainee who will not be a "daub and gob" type of weldor but a finished craftsman. The trainee of the future must be capable of doing a first class job of welding. Furthermore, he must know that the job is of a first class nature without the aid of an inspector or be capable, should the need arise, of doing a first-class job of welding inspection. And after having gained practical experience, he should be capable of supervising other weldors, who will also have passed through the same broad training.

The Twin City branch of the Ford Motor Co., St. Paul, augmented its supply of weldors by setting up a score of training booths on the floor of one plant. As soon as a sufficient number of weldors has been trained, the "school" will be discontinued and the portable arc-welders used elsewhere for actual production.

Courtesy, The Lincoln Electric Co.

The Ladies Speak

Is welding easy to learn? You can bet your hat it's not, say the Qualified Girl Weldors of Link-Belt Ordnance Co. Give trainees adequate learning periods, they plead, and save soldiers' lives!

So many articles, newspaper items and even trade books have deluged a gullible public concerning the "art of welding" or the "ease with which this task can be performed" that we, the Qualified Girl Weldors of Link-Belt Ordnance Co., have decided to state the truth.

Whereof We Speak

That we speak with authority is attested to by the facts that our company has earned the Army-Navy "E" award and that the product which we have helped to fabricate, an accurate and powerful gun, has stood the test of crucial action on many of our Army's victorious battle fronts.

Even with the knowledge we have acquired during the past year welding day after day or night after night, despite our painstaking and rigid training, each of us can truthfully say, "We still have a lot to learn."

Easy as Piano Playing

Any preconceived ideas we had that welding was easily and quickly learned were promptly dissipated during the first few days of our intensive training. Welding, we found, is as difficult to learn as playing the piano. And did you ever try to make music on the keys? At the end of the first week or even a month, weren't you amazed at how much you yet had to learn about playing? And if after a month of diligent practice you sat down and performed, do you think that you could make Casadesus look to his laurels?

The same is true of welding. After a month of constant practice you will be able to weld no better than a month-trained pianist can play.

In either case—welding or piano playing—a maze of technical terminology has to be mastered before a practical start can be made. The newcomer must learn the meaning of such terms as electrode, heat setting, all-purpose wire, fillet weld, speed of travel, length of arc, etc. Less easy is the assimilation of the four basic principles which every weldor must be able to apply on his every weldment. These are:

Girl weldors of the Link-Belt Ordnance Co.—one of the first groups of qualified women weldors in the city of Chicago—who have helped their company to earn an Army-Navy "E" by doing first-class, conscientious work.

1. The position of the electrode must be absolutely correct in order to secure the proper flow and puddling of the metal. In order to acquire this perfect position, perfect body position is also required. For how many weeks or months or years does a piano player strive for that perfect position which is so basically necessary? Or the golfer practice his stance?

2. The speed of travel at which the arc moves must be perfectly timed so that the fusion between the filler and the parent metal becomes a symmetric solid bead, rigidly holding the two pieces together.

3. The length at which the electrode must be held from the work is an exact distance, but a distance which varies with the size and type of electrode used and the thickness of the parts that are being fabricated.

4. The setting of the proper heat also varies with the size and type of electrode used and with the size of the weldments.

First Attempts

The results of our first attempts at laying the bead were in direct proportion to the confusion of our minds about what was going on outside our black helmets. Our first beads were as far removed from a "weldor's bead" as a beginner's piano "piece" is from the matchless performance of a Rachmaninoff.

Practice, practice, *practice* . . . hours and hours of diligently laying beads on a flat surface . . . and then we have just *begun!* From simple butt welds in the downhand position, we must pass onto more difficult fillet and corner-to-corner welding. To each new assignment must be applied the same conscientious endeavor, the same hours and hours of tireless practice. And still we are only *learning.*

One hour a day of theory, seven hours a day of practice! Weeks of this routine may pass before we see what we have been looking for through the dark lenses of our hoods: an oval pool of metal starting to form and solidify. Not until a weldor sees this pool, does he or she really begin to weld, for it is by controlling this molten oval that the perfect bead is formed and the fusion of the metals is complete.

This feeling is again akin to that experienced by the musician who suddenly *feels* the relation between the chords his fingers strike. Now both the player and the weldor are at a comparable degree of advancement. The player cannot yet give a recital, nor can the weldor be entrusted with the high standard of work of our demanding industry. And so what must be done in both cases? Practice and still more practice!

So many relative factors enter into welding that it is easy to understand why an endless patience must be exercised by the would-be weldor. The neglect of any single factor is enough to cause a defective weld and impair the strength of the parts that are being fabricated. Since each operator virtually holds in her own hands the lives of the men who are to use that part, the very greatest care must be exercised to train her thoroughly and completely. And this cannot be done with women—or with men—in one week or two weeks or three weeks.

We contend that if any management proceeds on the supposition that welding can be learned in so short a time—and permits it—the inevitable result can be only defective workmanship and its resultant defective war material. And this constitutes a betrayal of an industry which has contributed much to the war effort.

50,000 Spots per Day

Specialization speeds spot welding at Bell Aircraft Corp., where welding operators have just one job—to operate their machines. A conveyor for metal cleaning is one of the factors which help to attain as many as 50,625 spots per working day from a single welder.

By **JACOB JOACHIMI**

Asst. Mgr., Fabrication Plant,
Bell Aircraft Corporation

VOLUME production has been achieved in the spot-welding department of Bell Aircraft Corp. mainly because of two pertinent factors: (1) a cooling system which keeps water flowing through the tips at a temperature of 35 F and (2) a metal-cleaning system which permits up to 300% improvement in spots per tip. Bell Aircraft has kept pace with other advances in this particular phase of resistance welding, but the prime reasons behind the success of the department are the two which have been mentioned above.

Fig. 1—Web assembly which is a structural part of an Airacobra wing panel. Note the reinforcement rib spot welded to skin. The material is 0.072 in. thick.

It is acknowledged that machine improvements over the past years (so vast that a machine two years old is today practically obsolete) have figured most prominently in the advance of spot welding during this war era. Supplementing such machine improvements, however, is ingenuity in plant organization.

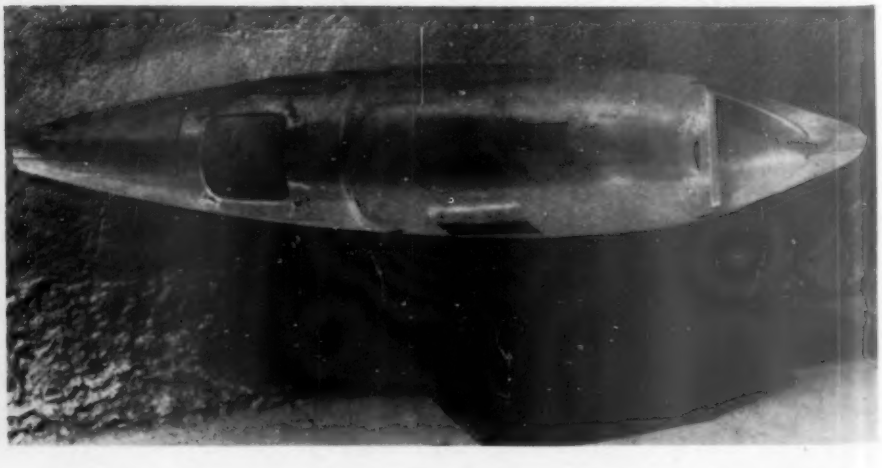
How Work Is Segregated

Spot-welding operators at Bell Aircraft have just one job—to operate their machines. The department has been broken down into four divisions in order to permit weldors to remain at their machines, and thereby to operate them at capacity, every hour of the day. The sequence of operations is cleaning, assembly, spot welding and finishing.

When the spot-welding department first takes custody of parts, they are stored on racks. The parts are then released to the cleaning division and subsequently to the other divisions of the department until they have become completed units such as the wing panel web assembly shown in Fig. 1 and the gun fairing shown in Fig. 2.

A rotating conveyor is utilized for cleaning. The assembly division of the department takes the parts from the cleaning conveyor and attaches them into units with spring-type sheet holders. The parts are then welded and turned over to the fourth division—appropriately entitled finishing—where dimpling, countersinking, drilling, riveting and the like take place. Finally the work leaves the spot-welding department, in practically all cases a completed subassembly ready for the paint dip and final assembly into cannon-carrying Airacobras.

Fig. 2—A view of the inside of a gun fairing, made of two halves joined by spot welding. The bulkheads and hand-hole door frame are also spot welded.



Segregation of these various stages of work has left the weldor free to devote all of his time to his machine, which, as a result, is almost constantly in operation. Little wonder, therefore, that visitors at Bell Aircraft are generally most impressed by the volume of work accomplished in the spot-welding department. The volume of spots per machine for an eight-hour shift runs as high as 18,000. Over the course of a full working day of 22½ hours, *as many as 50,625 spots* have been made on a single machine.

As before stated, the cleaning system is one of the factors largely responsible for this phenomenal output. Since chemical cleaning has supplanted cleaning by hand using steel wool, tips which once had to be dressed on an average of once every 150 spots are now able to deliver from 400 to 600 spots between dressings. In some instances, as many as 1,000 spots are made without redressing the tips.

Cuts Cleaning Time

The cleaning conveyor, which operates in merry-go-round fashion over five tanks placed to form a circle on the plant floor, has cut by 80% the time formerly consumed by hand cleaning with steel wool. Moreover, the personnel of the cleaning division has been sliced by almost 85% since the advent of the conveyor system.

Under the present set-up, six girls are employed in the cleaning division on each shift. With the aid of the conveyor, these six girls handle the cleaning of all aluminum parts throughout the shift. Other girls, however, are still required to clean parts containing steel or other material than aluminum since such parts cannot be chemically cleaned in the same tanks as aluminum.

The parts to be spot welded are loaded onto racks and picked up by the conveyor, which is hydraulically operated at any predetermined speed. The conveyor has six stations which revolve above 1,000-gallon tanks filled with liquid. The parts are lowered automatically into these tanks in the proper sequence. The machine is set to remain in the "down" position (the parts resting in the processing chemicals) for any predetermined length of time. (Five minutes is the usual processing time in each tank.) Then the racks are lifted to the "up" position, the conveyor swings ahead one station and the parts are lowered into the tank again. The conveyor stations are lifted and lowered simultaneously; *i.e.*, either all stations are in the up position or are in the down position at any given instant.

Loading and Unloading

Each conveyor station is carried systematically through the five tanks. Since there are, however, six stations but only five tanks, it is obvious that one station must lower into empty space each time that the conveyor descends to its down position. This empty space, located between the fifth and first tanks, is used for loading and unloading.

Three movable trucks are utilized by the cleaning division. Two of these are covered with screen racks while the third is bare. The bare truck waits at the unloading station to accept the screen rack coming out of the fifth and final processing tank and carries its load immediately into the drying station, where blowers are utilized with room heat. During this time, a second truck rolls its rack into the loading station in position to be picked up by the conveyor as it ascends to the up position, while the third truck has just rolled out of the drying station and is in the process of being unloaded and reloaded.

Cleaning and Rinsing Agents

The cleaning sequence is: vapor degreaser, chemical cleaner, agitated hot-water rinse, deoxidizer, agitated cold rinse. The No. 1 vat in the cycle holds the vapor degreaser, No. 2 vat the cleaning solution, No. 3 hot water, No. 4 the deoxidizer and the last vat merely cold water.

The solutions are kept at their proper strength by periodic additions and also by drawing off and replacing the entire contents from time to time. A sewage system permits the tanks to be emptied in a matter of minutes. For filling, valves at the individual tanks connect with the main supplies of the various fluids.

Coming off the cleaning drier, the parts go directly to the assembly division. The assembly takes place on benches, the work being accomplished for the most part with spring-type sheet holders The machine loading is determined prior to cleaning so that new layers of aluminum oxide will not have the chance to form prior to welding. Although the cleaning process will keep the metal in condition for welding over a period of more than eight hours, an attempt is made to maintain a parts bank of only four hours.

No Fixtures Needed

A 100% lofting system is utilized at Bell Aircraft. This has now reached a degree of perfection per-

Fig. 3—Some electrode holders are set at a 22½ deg angle in order to simplify particular welding jobs.

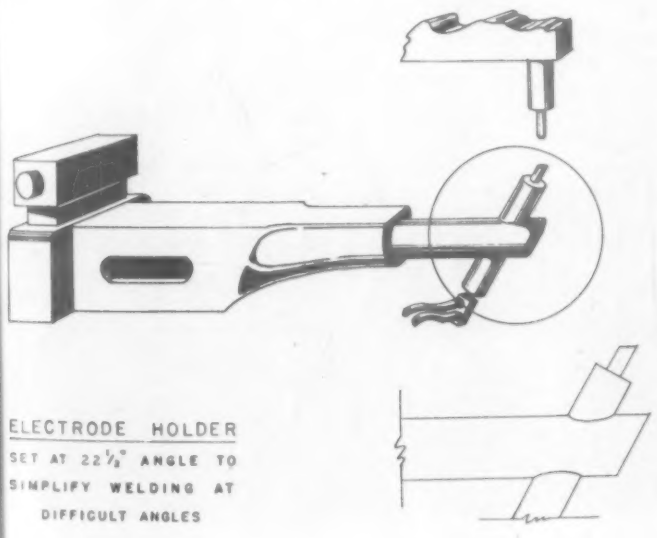


Fig. 4—Roll-type tip guide developed to assure a straight row of spot welds—highly important on lengthy parts.

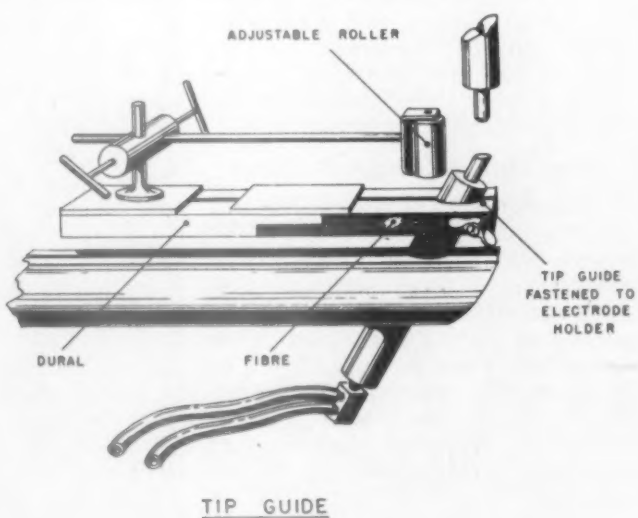


Fig. 5—A counter-balance takes the place of two men in the spot welding of a cabin door-frame.

Fig. 6—Cabin door-frame for the P-39 Airacobra. This is the part being spot welded in Fig. 5.

mitting assembly to be accomplished for the most part without the aid of fixtures. The parts are cut so accurately that they will fit together exactly, allowing the assembly to be accomplished with spring-type sheet holders. At one time, assembly to a fixture was necessary to assure correct tolerances when the parts reached the spot welding machines, but the improved lofting now provides the same assurance. Thus numerous assembly operations have been eliminated; *i.e.*, assembling parts to fixture, picking up necessary holes for sheet holder assembly, disassembling from fixture, wiring parts together to be forwarded to the cleaning unit, and returning the part from cleaning to be reassembled for the spot-welding machines.

Use Stored-Energy Welders

Stored-energy machines are utilized for the most part. Water-cooled ejector-type electrode holders have proved satisfactory. Three sizes of inlet water tubes are used: ⅛, 3/16 and ¼ in., and the distance of the water hole from the end of the tip is ¼ in. The electrode diameter is usually ⅝ in., some tapering to ⅜ and to ½ in. The electrodes are made of RWMA-Group A, Class 1 material.

The lower arms of some of our welders have been reworked at one end to 22½ deg as shown in Fig. 3 in order to make the machines more flexible. Special bars, used by some companies to weld complicated assemblies, are frowned on here for two reasons: first, they build up resistance and so cause inferior welding and, secondly, they are very hard to control.

Movable tables are used in conjunction with machines in order to facilitate the operator' work. Metal roll-type tip guides and roller stands fixed with carrier are utilized to facilitate spot-welding work on lengthy parts (see Fig. 4).

A counter-balance is used in assembling the Airacobra's cabin door. The counter-balance is obtained through the utilization of a weighted pulley, and the weight used equals that of the jig and part. Where two men were once needed to hold the assembly in position for welding—the weldor now handles the part by himself as shown in Fig 5. Fig. 6 shows the cabin door frame that is spot welded in this manner.

Double Reactors Speed Welding

The installation of double reactors to welders has stepped up the spot count by more than one-third. With the double reactors, kva are raised from 40 to 50 and the time taken to build up energy is reduced by 50%—which naturally increases the production output.

Installation of a by-pass in the air exhaust check valve has also tended to step up production by minimizing "off-time." Furthermore, the installation of new off-time relays has decreased off-time by at least 40%. With the relays installed, the spot count was increased from 80 to 130 spots per minute. Off-time has been even further decreased by stainless steel aprons on the armatures of short circuit relays and of series relays, installed in order to steady mechanical operation.

Electrode Cooling

Refrigerated water at 35 F is used. The water system which runs through the spot-welding department is independent of the regular plant supply. A main pipe carries water from the refrigerator, which is situated on a platform close to the ceiling. Each machine has a spur pipe running into the main. After passing through the machine, the water is carried by a second individual spur pipe into a second main, which returns it to the coil-refrigerator. All pipes are well insulated to help maintain the 35 F refrigerator temperature while the water is traveling to the welders.

A decrease in set-up time was brought about by the development of a water-tight, leakproof electrode holder. Besides eliminating all water

leaks, this holder has also cut replacement and maintenance cost; *i.e.*, the life of cleaning pads used in tip cleaning has been doubled because there is now no water on the tips.

Offset electrodes have been replaced by offset electrode holders which are tilted at the degree of angle best suited to the particular job. This type of holder eliminates a large share of the work which once went into replacing offset tips since all that is necessary now is to loosen the bolts and tilt the electrode holder to the desired angle. The amount of resistance is lessened, resulting in more spots per dressing and better weld consistency.

Tests and Checks

Before a job starts, inspectors check the machines for heat. Then samples of the identical material to used in a particular job are welded for pull tests. The test results are checked against Army specifications; if satisfactory, welding is allowed to begin. To guard against any possibility of unsatisfactory work, similar pull tests are made every half hour on each machine after the job has been started. In the event of a poor spot appearing in the test, the work of the previous half hour is checked back to locate where the poor work first occurred.

Actual pull-tests have proved to our satisfaction that a spot weld is as strong as a flush rivet. Since spot welding, moreover, affords a great saving in man-hours over riveting, we are routing more and more structural parts to the spot-welding department

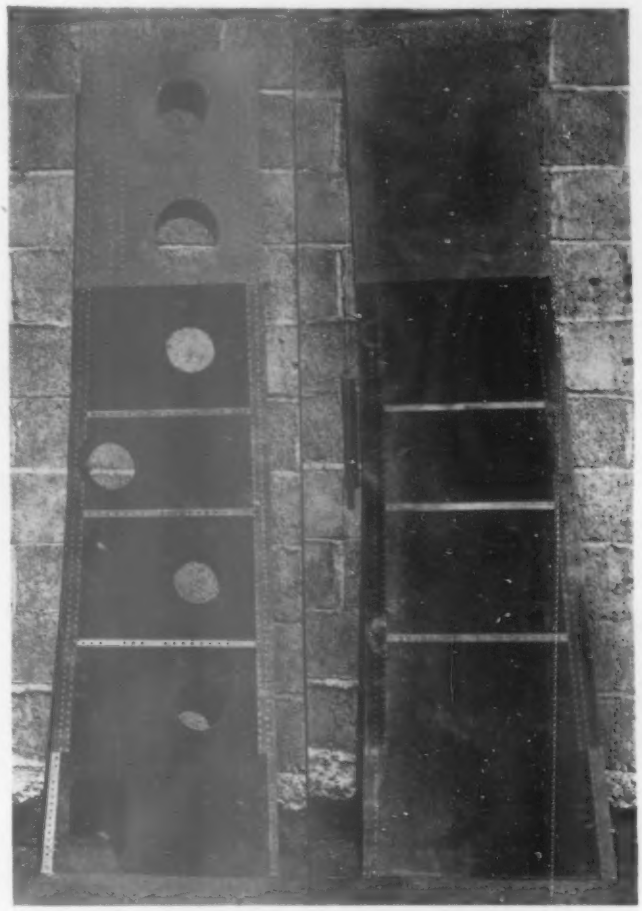


Fig. 8—On left is a gas tank cover for a P-39 after it has been blanked and pierced. On the right is the same structural part as it leaves the spot-welding department.

Roll welding machines, Fig. 7, have increased the volume of work in the department. This new type of machine is especially useful on flat work, such as gas-tank covers and cowling. The roll is of RWMA-Group A, Class 1 material and is cooled by the same water system which is utilized on all other machines in the department. From 250 to 300 spots per minute are accomplished.

A typical job is the welding of numerous reinforcements to gas tank covers measuring 8 by 3 ft. This requires individual technique due to the large number of attachment holes in the outside reinforcement and skin (see Fig. 8). It is necessary to line up the holes, which was extremely difficult until an individual method had been devised.

The job was greatly simplified by shearing both the 0.065 in. skin and 0.025 in. reinforcements from ⅛ to ½ in. oversize. The oversized material is put through the chemical cleaning conveyor with other work. The skin is then placed under a marking template and marked with pencil. The template removed, the reinforcements are positioned with sheet holders according to the markings on the skin, tacked up and then put through the roll welder.

When the welding of the outside reinforcement is complete, the job is rerouted to the proper department for blanking to size and piercing of necessary holes. The job then returns to the spot-welding department for attachment of inside reinforcements —including a plate with camlocks— on the roll welder. The method is simple and provides perfect alignment of the holes.

Fig 7—Roll welders capable of making 250 to 300 spots per minute are utilized for assembling large gas tank covers and for other flat work.

Fig. 1—This broken cylinder was a sorry sight to the inexperienced. It appeared that it could never be put together, but—

Fig. 2—The cylinder was aligned with pieces of 1 in. steel that had been machined and drilled to conform with the stud drilling.

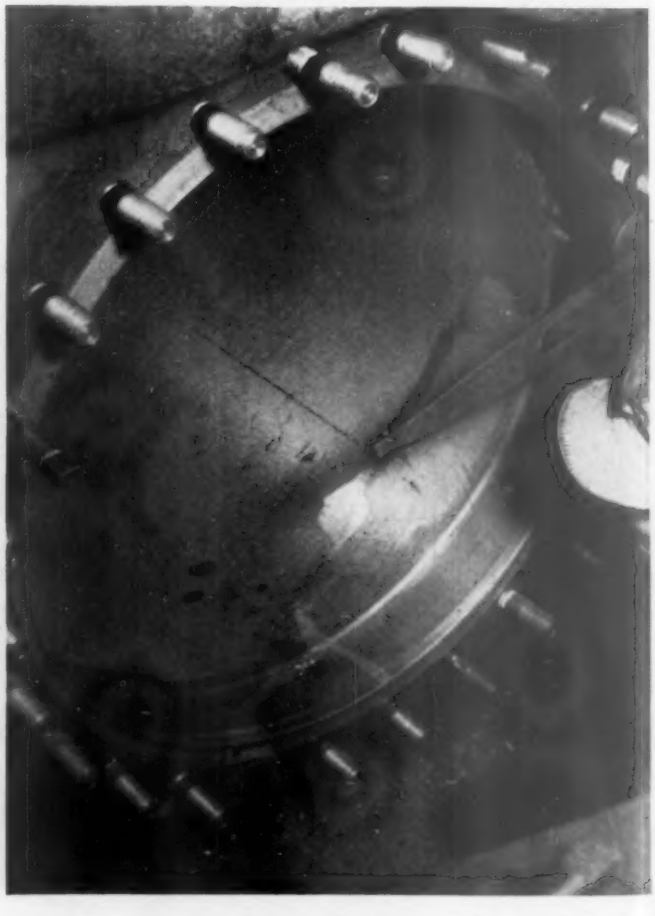
Wartime

FROM every quarter we hear of the tremendous strides being made in welded fabrication and construction during this war. We who are intimately associated with the welding industry are proud that our chosen profession is responsible for the accelerated output of planes, tanks, guns and ships. However, welding is playing another extremely important part in our war effort—a part that is seldom mentioned but is just as vital as any welding done on tank, ship or plane. This welding is that done for the maintenance of our locomotives and freight cars. In view of the prevailing shortage of parts and the difficulty encountered in getting replacements for many of the essential operating devices, one often wonders if it would be possible to operate a railroad at all today were it not for the miracles constantly being performed with the torch and electrode.

The average railroad weldor gives little thought to the importance of his efforts, considering it all in a day's work, but those of us who stop and think know that our rail transportation would most certainly be bogged down without the railroad welding operators' unusual skill and ability to handle any and all welding problems.

The railroad weldor differs from most weldors, and especially from those engaged in mass production of parts for the engines of war. He must be equally skillful with the torch or electrode and must be able to weld in any position, on any metal, and must be able to handle any assignment whether it be a locomotive frame or

Fig. 3—And when welded, the cylinder was as good as new.



Railroad Welding

Today new parts can be obtained, if at all, only after long delays, but our rolling stock is kept rolling by weldors capable of working miracles with their torches.

By ARTHUR HAVENS

a highly intricate aluminum casting.

Disaster in a Snow Storm

A splendid illustration of railroad weldors' ability to apply welding to keep a locomotive in service during this emergency happened a few months back. A big Pacific type engine, one of three of this class owned by a small eastern road, was speeding homeward through a blinding blizzard, hauling behind it several cars of holiday-bound passengers. In the brightly lighted coaches there was a warm, comfortable atmosphere of gaiety, which continued even when the train was brought to a sudden stop. The passengers made many good-natured comments about the rough handling of the train by the engineer, little realizing that up in front the train crew were wading through waist-deep snow to survey one of the most tragic engine failures that could possibly have happened.

There was a terminal a short distance away, and so another locomotive was soon coupled to the train. The unsuspecting passengers continued on to their destinations. Not so, however, the panting giant of the rails! Morning light revealed the full extent of the damage, which, to the uninitiated, surely looked irreparable. The left main crank pin had sheared off close to the wheel center. The massive side and main rods had churned around like the flailing arms of a windmill, destroying all in the path of their tremendous weight and speed. Running boards, pump, link trunnion casting, guide yoke, guides, brake hanger brackets, in fact every casting on both sides of the locomotive, were either bent or broken. To top it all, the left piston had banged its way out of the cylinder, taking a huge piece of the cylinder wall and bushing with it. All in all, it was a pretty sorry sight.

This locomotive was soon towed to the main shop, stripped and turned over to the weldors to put back in running condition as soon as possible. To an inexperienced operator, this would be a large order but not so to the oldtimer, for he knows that with his ingenuity plus his cutting torch and welding torch practically nothing is impossible.

Since the cylinder would require the most machine work, it was the first job to be tackled. Fig. 1 shows the full extent of the damage. When broken cylinders are welded, a new bushing is normally applied, but inspection of the stock pile of bushings revealed that no bushing of this type was available. It was therefore necessary to fit the broken pieces back into place close enough so that the cylinder could be bored without making it too large for continued use.

Broken Cylinder Big Problem

To make bad matters worse, the bushing was not broken as far back as the cylinder wall, so the 2½ in. thick cylinder had to be chipped and brazed in an overhead position. This in itself would offer a serious problem for most weldors, but not for the railroad weldor, who has done the same thing dozens of times in his many years of welding.

To hold the broken pieces in place with a high degree of accuracy, pieces of 1 in. steel were machined and drilled to conform with the stud drilling of the cylinder. These pieces were fastened on the studs remaining on the unbroken part of the cylinder. New studs were then applied in the broken pieces, and they in turn were replaced in their original position. The many broken pieces of the bushing were either chipped or ground, and they too were replaced and held securely with many steel clamps. Fig. 2 shows the cylinder ready for welding. When all was aligned perfectly, a small furnace was built around the affected part of the cylinder, and the whole assembly was preheated to a sizzling heat. Brazing was started by two operators, and in six hours some 80 lb of bronze had been applied. The furnace was sealed up, and the cylinder left to cool till the next day. The boring arrangement was then set up; a light cut was taken through the bore, and the cylinder head seat was faced off. The cylinder that had seemed broken beyond repair was just as good as new again, Fig. 3.

Fig. 4—One of the welding operators snapped this picture of a locomotive guide yoke that had to be repaired by welding. Note the extent of the break and the aligning plate which was used to hold the pieces together.

Holding Yoke Alignment

That was only the first job; there were many more. The massive steel guide yoke, broken into two pieces, was another job that had to be held in perfect alignment. If this part were out of square, it would require a great deal of difficult machining and might spoil the fit of the link trunnion. Once again a heavy steel plate was planed and drilled identical with the drilling in the link trunnion casting fitting on the guide yoke. The casting was veed from both sides, the cut cleaned thoroughly and the broken pieces fitted together with fitted bolts in the aligning plate. This also was a job for two operators, who welded from both sides simultaneously in order to lessen the possibility of distortion. One of the operators has left his position to snap the picture, Fig. 4, which clearly shows the break and the method of holding the part in line. This guide yoke, incidentally, needed no remachining before being replaced on the engine.

With the guide yoke in place and in perfect condition, it was a short job to bolt the broken link trunnion casting temporarily in its accustomed position. This casting was also in two pieces, but with both supporting castings welded and straightened, it was

Fig. 5—Trailer pedestal shoes being fabricated by flame-cutting from formed steel channels. It had proved impossible to buy such shoes, but the locomotive had to be kept in service.

a simple matter to align the link trunnion and weld it. One operator completed the welding in record time without any distortion. It was comforting to the management to know that these oxy-acetylene welded castings would prove as satisfactory as when new.

Heat-Straightening Bent Yoke

The brake hanger post brackets were also welded, and the bent ones straightened. The other guide yoke was not so severely broken, but it was badly bent. After estimating the cost of removal, the foreman decided that it would be more economical to straighten it on the engine. The weldors were called in on this job because it would be necessary to heat the heavy casting with large torch tips. A small jack was placed in the proper position while the guide yoke was heated a bright red with two torches. Pressure was then applied with the jack, and the huge casting was forced back into the proper shape. So close did the casting come to its normal position that the original bolts could be driven back into place. Meanwhile workers in other parts of the shop were not idle.

By this time, new side rods had been prepared; the links were straightened and ground; broken and bent air and steam pipes had been straightened and welded, and the engine was soon assembled and back to work on its fast run. Were it not for the oxy-acetylene process, however, that engine would have been in the shop for weeks, possibly months, waiting for parts to arrive!

Galled Floating Plates

Not so long ago another passenger engine was in the shop for a complete overhaul and was fitted out with new automatic driving box compensators. This was a trial set and the only one on the road. Due to some inconsistency in the application, the driving boxes all ran hot, and after some four weeks of modified use the engine was returned to the shop for different boxes. It was then discovered that the main floating plates were so badly galled that they could not be used. This would not have been a serious condition had it not been for the fact that this was the only set of compensators on the road, so, naturally, there were no more floating plates available.

The floating plate, as the name implies, is a loose cast iron plate ¾ by 6 by 21 in. which is fitted between the compensator and the driving box. A steel plate would be out of the question. Learning that the machine foreman was in trouble, the welding supervisor suggested that the two galled plates be covered with a layer of wear-resisting bronze and then planed back to size. This brought a quick affirmative answer, though the foreman felt that the plates would probably be warped out of shape. The floating plates were clamped securely to a heavy flat casting, and an ⅛ in. layer of bronze was applied to one side of each. The plates were left to cool, after which they were removed and planed to size. In spite of the foreman's skepticism, there was no warpage or distortion.

A similar application of weldor's ingenuity is shown in Fig. 5—the flame-cutting of trailer pedestal shoes. New shoes could not be purchased but the locomotive had to be kept in operation—and it was.

All welding jobs are not pleasant, and I marvel at the fact that weldors will continue to suggest welding applications when they know they are letting themselves in for much hard work and often real physical discomfort. An example of a particular nasty welding job is shown in Fig. 6.

Welding in a Conduit

The main steam line of a railroad terminal was piped several hundred ft through a conduit of 5 ft diam. The cast iron expansion joint in the center of the conduit had leaked badly for some time, but everyone had ducked repairing this leak because of the excessive heat in the tunnel and because of the miserable working conditions. Nevertheless, the leak finally got so bad that something had to be done. The pipers who inspected the joint found that they had no parts to repair the faulty expansion arrangement so the good-natured weldor suggested that they let him remove the joint and weld in a straight piece of 4 in. pipe. The suggestion was received with joy, and the weldor had himself a job.

The work could not be done with-

Fig. 6—This weldor spent a miserable few hours repairing a leaky steam line in a 5 ft conduit. Because of the excessive heat in the conduit, he nearly dropped from exhaustion several times before the job was finished.

out a blast of air blowing in the weldor's face all of the time; even with this precaution he almost dropped from exhaustion several times. However, he stuck with it and in time had the steam back into all of the lines supplying several shops. The pipers had found a soft cure for their particular headache.

Making New Pipe Fitting

A few weeks later the pipers had another job for that weldor. Up under the ceiling was a large cast iron fitting used as a T-branch, reducer and drip pot. Nearly all the flanges connecting this large casting were cracked and so was the casting itself. New cast fittings could not be obtained. All the weldor was asked to do was to make a replacement out of pipe and to weld it in place without shutting the steam down long enough for the shop to cool. This, it should be explained, was in the dead of a Vermont winter when unheated shops cool quickly.

In spite of all the things said to the contrary, weldors are usually looking for a chance to use their skill, and this was an ideal spot to show what really could be accomplished with the torch and rod and a few pieces of pipe. A replacement fitting was soon fabricated. Then the main steam line was shut down just before the lunch period, and the weldor got into high gear. Shortly after lunch, the steam was returned to the line with everything O.K. again. No doubt the weldor smiled to himself as he thought of all the welded pipe jobs he would be getting in the future. The prophecy came true, for the entire steam line was later removed and replaced by an all-welded line. This time some of the radiators were made from welded pipe, as shown in Fig. 7.

Fig. 7—Fabricating radiators for an all-welded steam line.

Making the Milk Train

When the railroad weldor runs across a really urgent welding job in the engine house, he has to be as fast as a bomber over Berlin. For example, a heavy 4-6-2 passenger locomotive came in with a broken radius rod extension. This engine was marked up for the milk train at 6 p. m., and there was nothing else to take its place. So the blacksmith forged a piece of 2½ in. square steel while the weldor scarfed the fork end of the broken rod. As soon as the blacksmith's piece was ready, the weldor took it and scarfed it while it was hot. He singed his fingers several times but finally succeeded in aligning the two parts and welding them securely. The machinist was no less anxious to get the engine in service so he put the job in the draw cut shaper while it was still hot. Before the metal was entirely cool, the radius bar extension was back on the engine, which was ready for the milk train at 5:45. Now that motive power is so vitally needed, what would happen to the country if railroad shops couldn't perform these minor miracles? I shudder to think of it.

Brazing a worn spot in a copper pipe is a fairly simple welding job when the pipe is easily accessible, but quite a different problem when the pipe is under the jacket and up on the boiler butt of a hot engine. Usually, these pipes chafe where they go through the jacket, and it is not uncommon to find one so badly worn that the bronze will fill the pipe when the weldor attempts to braze it and thus render it unfit for use. This pipe must then be sawed into two pieces, the bad section removed and a sleeve of the next size larger copper pipe slipped over both ends and brazed in place. Odd jobs such as this often save dumping an engine.

Safe Ending Superheater Flues

On large, well equipped railroads, all kinds of special machines are bought to carry on the speedy repair of locomotives, but in the small shops we must depend on whatever equipment we have to get the job done. An example is the welding of new ends on superheater flues. In large shops this is all done in large furnaces in which proper preheating temperatures are easily obtained, but in the small shop the oxy-acetylene torch must be called upon to fill the gap

Fig. 8—Safe ending superheater flues with the oxy-acetylene torch. In big shops, this work is done in special furnaces.

in equipment. However, there is a great deal of satisfaction in looking back over the several years we have been safe ending superheater flues with the torch, as shown in Fig. 8. There has never been a failure or a leak from an oxy-acetylene welded safe end.

Anyone in close touch with locomotive repair methods over a period of years has seen the boilermaker gradually replaced by the weldor until today, with but a few exceptions, most major boiler repairs are just big welding jobs. Entire fire boxes are welded into place; worn parts of side, flue and door sheets are cut out with the torch and patches welded into place; siphons are welded to the crown sheet; ash pans are all welded (and much more serviceable); in fact, every part of the boiler excepting the shell comes in for its share of welding. One can hardly blame the weldor for being just a little proud when he thinks back just a few short years—to 25 years ago when welding was just a creeping infant . . . when the weldor's list of successful applications would contain about ten jobs . . . when the weldor trundled his tanks and equipment around the shop on a cart and spent most of the day trying to do something he couldn't. Today the acetylene equipment is housed in a neat house, and the acetylene and oxygen are piped through elaborate pipe lines for weldors who are busy on all kinds of jobs and practically never have a failure.

We often hear the statement that some day all locomotive repair men will be either weldors or weldors' helpers. That is a bit exaggerated, but without a shadow of doubt welding *is* today the most important tool employed in the railroad machine shop.

★ RESEARCH

Injurious Welding Fumes

A welding operator discusses welding fumes in non-technical and non-medical language. This is an unprejudiced account based on the experience of a man familiar with all the practical aspects.

By **JOSEPH SCHUMAN WRIGHT**

THREE types of fumes having injurious effects are commonly encountered by weldors working on ships. These fumes are from: (1) galvanized iron, (2) from the stainless steel electrodes used in welding high tensile steels, (3) from the burning of lead-based paints and (4) from aluminum welding operations.

Galvanized Iron Fumes

Iron is galvanized by dipping it into molten zinc—the process is called "galvanizing" because of the electrolytic affinity which zinc has for iron. This galvanic or electrical action results in so great a natural attraction between the molecules of iron and the molecules of zinc that the zinc coating will resist oxidation of the iron and so prevent the formation of rust.

Many weldors believe that galvanizing contains a high percentage of lead. This is a false impression. Galvanizers do not as a rule put lead into their zinc since the presence of lead or tin does not help the galvanizing process. Even though minute amounts of lead may sometimes be present as an impurity, there is a big and important difference between the effects of zinc fumes and those of lead fumes; namely, zinc oxide is *not* soluble in the blood stream and therefore will not be able to enter it, while lead oxide *is soluble* and enters easily into the blood stream.

Galvanizing fumes from zinc oxide are not poisonous or, as doctors say, are non-toxic. However, when they are breathed in excessive quantities, they will produce the symptoms of the illness known as metal fume fever or zinc chills, which is not a pleasant experience. Persons who have had an attack will remember the symptoms.

Many weldors believe that metallic zinc oxides and the other dusts that the weldor breathes accumulate in the lungs. For their own peace of mind and confidence, therefore, they should have an understanding of the physiological ability of the lungs to cleanse themselves. Upon entering the lungs, the insoluble dusts and oxides are lodged in the moist, sticky phlegm lining the respiratory tissues. This phlegm is constantly moving from the lungs, outward towards the throat, and is assisted in this movement by small, hairlike structures in the tissue of the lungs. These keep whipping the phlegm up the throat and out.

The movement of phlegm is stimulated by the amount of dust or insoluble fumes breathed. For this reason, the weldor who has been exposed to dust or fumes from galvanized material will find himself spitting up more phlegm than ordinarily. This is a good sign. The passage of phlegm should always be encouraged, for it is the attempt of the lungs to cleanse themselves of the inhaled dusts.

If a weldor knows that he has been exposed to an excessive amount of galvanizing fumes, he can help to prevent the occurrence of metal fume fever by taking these precautions:

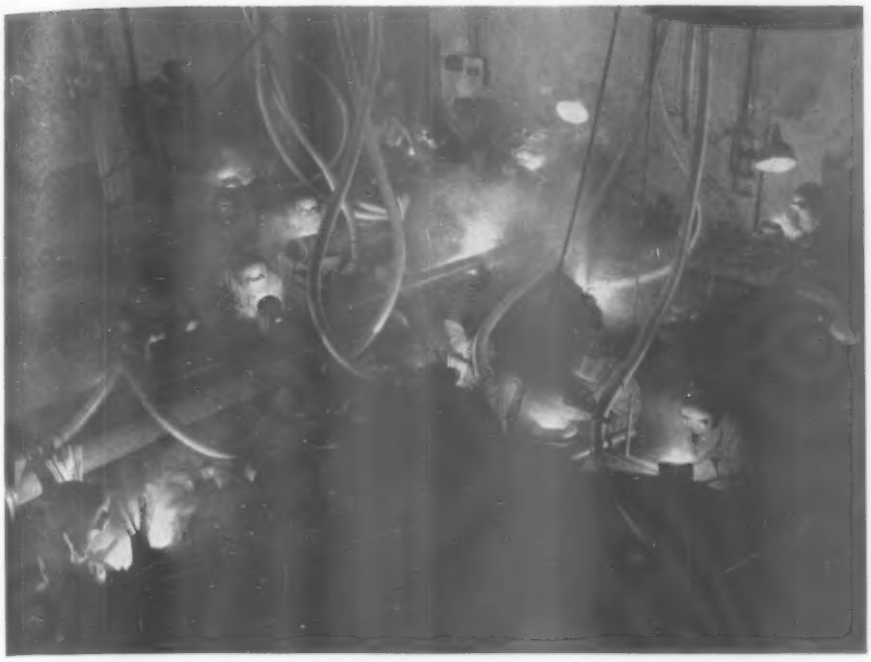
(1) Drink large quantities of milk (especially warm milk, if possible.)

(2) Keep his body warm. Exposure of the body to cold or damp surroundings should be prevented.

(3) Avoid drinking soda pop and carbonated beverages of the cola type.

It is advisable for every weldor to

Weldors working in the confined spaces of shipholds are apt to be affected by injurious types of welding fumes unless proper care is taken.



Pipe weldors at work over the main pipe shop, Oregon Shipbuilding Corp. The suction hoses (hanging from above) draw the fumes and smoke from each working weldor.

cultivate the habit of drinking milk. Milk is not only a readily assimilated food, but it increases the calcium intake and, to this extent, may make the body somewhat more resistant to the effects of some poisons.

Stainless Steel Fumes

Stainless steel electrodes are now being commonly used in welding high tensile steels. Two common varieties of stainless steel alloys exist—the 18-8 and the 25-20 alloys. The first contains 18% chromium and 8% nickel; the 25-20 contains 25% chromium and 20% nickel.

Though the high percentage of metallic chromium contained in these electrodes is not in itself the cause of any special irritation, fluxes or rod coatings containing fluorides are often used in the welding of alloys containing chromium. Hence the effects of breathing large quantities of fumes from stainless steel electrodes appear quicker and are usually more intense than those of galvanizing fumes.

Lead-Paint Fumes

Under actual working conditions, the most injurious fumes encountered in welding are the fumes produced by burning lead paints. This is true because of the widespread use of lead-based paints and also because of the poisonous effects of lead oxide, which is produced whenever lead paint is burned. Lead oxide is very soluble and quickly enters the blood stream, thus causing lead poisoning.

In all cases where it is necessary to weld painted metal, the paint should be carefully scraped or chipped off. No chances should be taken because most paints are lead-based and will produce injurious fumes if burned. The presence of lead paint in the weld will also result in an inferior, porous weld, so it is equally essential from the point of view of doing a satisfactory job to have the paint removed by scraping or chipping.

Care must be taken to remove the paint from the reverse side of a metal bulkhead. The paint on the reverse side also burns, creating dense lead oxide fumes. Furthermore, this paint may burst into flames, perhaps even starting a serious fire if it is not removed.

Aluminum Welding Fumes

Aluminum is difficult to weld because of the coating of aluminum oxide which forms on products of metallic aluminum. The oxide must be dissolved before welding can take place, and ordinary fluxes cannot accomplish this. Only the most powerful chemical fluxes will dissolve aluminum oxide. For this purpose, compounds of fluorides are used.

Fluoride, in many of its forms, is poisonous; it is highly soluble and quickly enters the blood when breathed.* Therefore, fluorides as they occur in welding fumes are dangerous. If a weldor has been exposed to excessive quantities of fluoride fumes, a doctor should be called immediately. In the meantime, the weldor should rest completely and keep his body as warm as possible.

Collecting Fumes

All of the fumes we have considered are harmful only when breathed in excessive quantities. Aluminum, high tensile steels and galvanized iron are being welded every day in large quantities without any adverse effects. However, the weldor must practice the proper safety precautions.

When welding on any work producing injurious fumes, he *must* have a sufficiently powerful suction blower *close* to his arc. The usual practice is to use a suction blower to which is attached a 4 in. flexible metal tube. The end of this metal tube is held four or five inches from the crater of the arc. In this way, all the injurious fumes are withdrawn from the presence of the weldor.

The other end of the blower should blow the smoke and fumes outdoors. Blowing them back elsewhere in the room, or into another compartment where other men are working, is unhealthy and unethical. Another 4 in. flexible tube should be attached to the exhaust end of the blower in order to carry the fumes out of the compartment, room or hold and exhaust them into the open air.

* There are some compounds of fluorine which are not poisonous and are almost insoluble. Long continued exposures to these have failed to develop any symptoms.—*The Editors*

Weldors working inside a large motor frame. This is the type of application for which special ventilation is recommended.

The Welding Engineer—

★ Part One—The welding engineer's job varies greatly from firm to firm. Still there are certain basic responsibilities which are more or less common to all organizations. These will be discussed in detail in this three-part series on arc welding engineering problems.

With the increase in the use of arc welding for the manufacture of machinery and equipment during the past few years (an increase especially augmented by the production of large amounts of equipment for military purposes), the problem of training capable specialists for welding control and processing has become one of vital importance.

Need Scientific Evaluation

The fundamental idea of welding engineering is that by scientific, objective study and evaluation of the elements of a situation a choice of equipment may be made or a welding method may be developed which can be demonstrated to be sufficiently better, either in cost or quality of the finished product, than other possible ways.

A manufacturing organization which produces the heavy earth-moving equipment unit shown in Fig. 1 will encounter somewhat different problems from a manufacturer of airplane fuselages or from a shipyard. Also, the problem of any mass production shop is naturally different from the organization operating as a large job shop producing equipment built to special order. However, if large mass production manufacturers build special shop machinery or fixtures (such as the flame-cutting machine shown in Fig. 2), they will encounter many of the problems confronting the specialized job shop.

In considering the work of the welding engineer, it must be kept in mind that all of the various fields of operation which might be considered to be welding engineering are beyond the scope of one individual in any but the very smallest of organizations. Though in some organizations, these various fields may be centered around one man or a very small group of men, in others they may be quite widely shared by many people in the organization. With this in mind, the following list of general operations and problems of organization represents the welding engineering functions which *someone* in the company should know and should be able to perform:

Welding Engineering Functions

1. Evaluate and select welding processes, machines and equipment.
2. Evaluate and select appropriate welding electrodes for all processing done in the plant.
3. Examine and evaluate welding operators seeking employment.
4. Train and adapt weldors to the company's special processes.
5. Correlate welding design with practical shop practice and available shop equipment.
6. Create production fixtures for welding. This, of course, includes the setting up and positioning of work for welding.
7. Establish the general procedures for welding the company's products.
8. Establish a production control of procedures in detail.
9. Establish quality control (inspection).
10. Keep abreast of practices and processes as they develop in the welding industry.

To select any portion of this group of functions and establish it as the special work of one person called a welding engineer and then to apply that particular selection of duties to the profession of welding engineer for all organizations would, of course, be a completely impossible plan. Nevertheless, the duties of a welding engineer in any organization will certainly include some of the ten general fields and perhaps a portion of all of them. The reader is asked, however, to bear in mind that the grouping of these functions as the work of particular welding engineers will vary greatly from organization to organization.

I. Selecting Processes, Equipment

After an organization has reached the fundamental decision to manufacture by the arc welding method, there are still questions galore to be answered as to the type of welding machine and equipment that should be used. Some of these will now be taken up in detail.

Should a-c or d-c welders be purchased? This is strictly a welding engineering problem. Someone in the organization must know or find out—based on a study of material, power, type of product, etc—whether the use of alternating current from a transformer-type welding machine, such as is used by the weldor in Fig. 3, or of direct current from a motor-generator set is most practicable for the particular organization.

Can parts of the manufacturing process be better done by automatic welding? A study of the comparative advantages of automatic and manual welding is also a purely welding engineering problem.

What make of machines to buy? The problem of selecting from the available sources the particular machine which shall be used in the plant or the best machine to replace existing sets when they become obsolete is another problem of welding engineering.

What size of machine? The determination of the size (or capacity) of the machine can only be reached after the welding engineer has considered the type of work which is going to be done, the variety of work which the machine will have to do

Fig. 1—An example of modern mass production of arc welded equipment, these wheel-type tractors and earth-moving scrapers are produced in lots of 100 or more by specialized workmen on modern manufacturing and assembly lines.

By **WALTER J. BROOKING**
Director of Testing & Research,
R. G. LeTourneau, Inc.

What's His Job?

Fig. 2—Mass producers of arc welded products have many typical "job shop" jobs if they build their own special equipment. This automatic flame-cutting unit was designed and built to cut special cutter-blade sections from rolled stock.

Fig. 3—The selection of the best type of welding equipment for the job is one of the problems of welding engineering. An a-c welder was chosen for the mass production of this part of a heavy earth-moving machine.

(with special attention to variety of sizes and types of electrodes) and relative continuity of use (minutes per hour for up to 24 hours a day.)

Machine Comparison Tests

In order to test and evaluate machines comparatively within a group of fundamental types (a-c transformer or d-c motor-generator or automatic welding), an analysis of rather technical nature is required. The man who does this work need not necessarily be a full-fledged electrical engineer, but he must be able to understand certain considerations of power consumption, fundamental efficiency and equipment investment.

The actual comparison of machines within a group—that is the process of comparatively testing them on the basis of operation, operating characteristics, overall efficiency and probable satisfactory service—may best be accomplished by objective comparative tests plus examinations of the machines from the mechanical standpoint.

The tests should always include actual deposition tests in which a certain number of electrodes is consumed or specified quantity of welding done under controlled conditions. Whenever possible, they should also include careful overall consumption studies, using a recording kilowatt meter or some other means of determining the amount of power used. The amount of time (labor) required to do a certain job of deposition of metal should also be measured.

Such tests should include a study of the extremes in setting and operating of the machines. It is desirable to know the lowest amperage possible to obtain and also the reaction of the machine at very low settings or very high settings.

The recording kilowatt meter may be used to describe the comparative speeds with which welding machines may be brought to welding efficiency after the arc has been struck. Fig. 4 shows such a recording of the arc-striking characteristics of three separate machines and demonstrates a very noticeable difference between them.

Besides welding machines, other equipment such as hoods, cover glasses, electrode holders, cables, cleaning brushes and slagging tools must also be selected and evaluated by the welding engineer.

Other Problems

Methods of grounding welders, the installation of the grounds and the arrangement of machines in the factory for efficient welding are also related problems requiring study. These problems are all of the type which offers a variety of solutions. Someone in the organization (whether he is called the welding engineer or something else) should conduct objective tests and arrive at an answer which can be demonstrated as the best of the several. This procedure constitutes the engineering approach to any problem.

Part Two will appear in an early issue of THE WELDING ENGINEER.

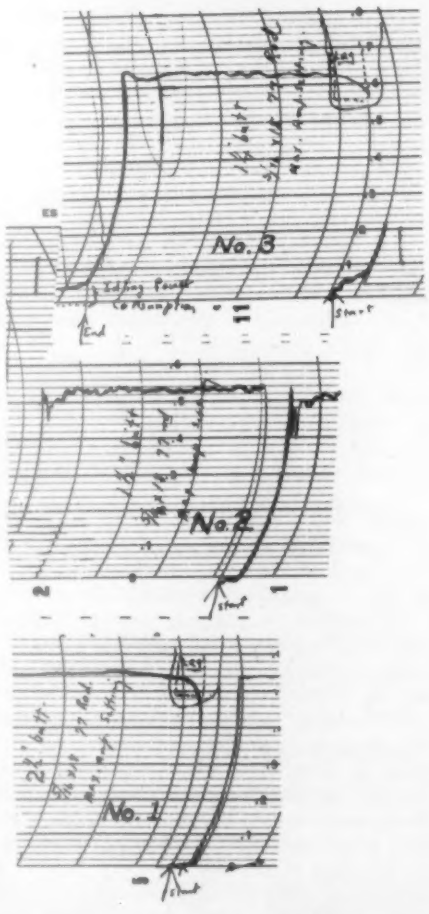


Fig. 4—Automatic recording equipment for testing welding machines or electrodes provides the welding engineer with valuable data. Note the difference between machine No. 2 and machines No. 1 and No. 3 as shown by the recording kilowatt meter. No. 2 rises immediately to full welding current delivery after striking the arc; No. 1 and No. 3 lag in output for several seconds.

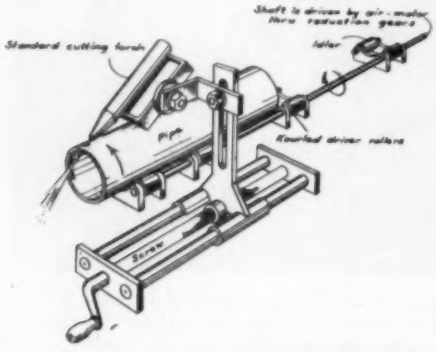
Short Cuts and Kinks

The Exchange of Ideas Leads to Progress

Pipe-Beveling Machine

By *I. CHAPMAN* and *G. ALLEN*

AT OREGON SHIPBUILDING CORP., we salvage odd lengths of pipe by beveling and welding them to form standard 20 ft lengths. Each month over 20,000 lineal



Pipe-beveling device designed by Ivan Chapman and George Allen of Oregon Shipbuilding Corp.

feet of pipe are salvaged in this manner. Until recently, the beveling was done manually. One man rotated the pipe on a set of rolls while a flame-cutting operator burned the desired bevel with a manual cutting torch as the pipe turned. This set-up was slow and very often inaccurate. It occurred to us that a machine could be devised to do this job.

To speed up the work, we developed a table having an automatic pipe-beveling machine. We submitted this idea to the Labor Management Committee and were awarded a prize for it.

A schematic drawing of the machine is shown in the accompanying sketch. The beveling unit is mounted on an iron table, and the shaft is driven by an air motor through reduction gears. Five sets of 2 in. rolls are in alignment along the entire length of one side of the table, and these serve as dollies for the pipe. A valve at the torch end of the table regulates the speed at which the rollers rotate.

A standard cutting torch is mounted in a holding fixture carried on two ¾ in. guide rods. Parallel to the side of the table and set about 3 in. apart, these rods guide the torch-holding fixture in a manner to insure its movement parallel to the axis of the rotating pipe. The torch may be moved forward and backward along the guide rods by means of a turn bolt between them; this bolt is attached to a hand wheel mounted on the edge of the table.

The pipe beveled on this machine is in short lengths from two feet up. All the pieces are odd lengths which have been hydrostatically tested to 550 psi. Changing to the automatic pipe-beveling machine has made it possible to save as much as 50% of the man-hours of labor which were involved in the previous method of pipe salvage.

Though the exchange of ideas among workers and managements is valuable in peacetime, it is invaluable in time of war, for such an exchange may help materially to shorten the conflict. Hence the appearance of "Short Cuts and Kinks," a new department of THE WELDING ENGINEER. On these pages, the editors hope to pass on to you ideas which will: (1) save time and money and (2) help to make difficult jobs easier and hard work more pleasant.

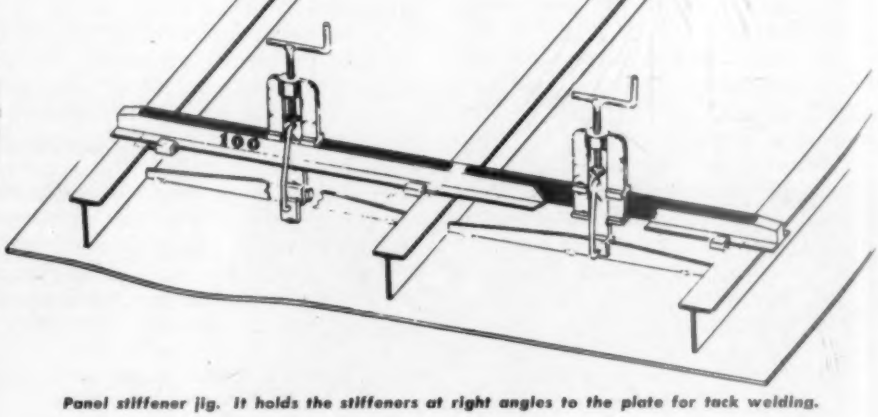
This is the one place where you may "get more than you put in," for all the ideas given here are yours without contributing anything in return. Don't be that kind of fellow, though! If you have a welding idea to pass on, then get the kick of seeing your name in print, help others to win the war and help us to keep this feature alive. Send anything you think suitable to Short Cuts and Kinks, THE WELDING ENGINEER, 506 South Wabash Ave., Chicago 5.—*The Editors.*

Panel Alignment Fixture

By *R. B. BROWN*

I WAS AWARDED a prize in a recent War Production Committee drive at the Bethlehem Steel Plant, San Francisco, on a rather simple device to insure the proper alignment of panels. This was a fixture designed to hold panel stiffeners at right angles to the plate and firmly against it while tack welding is being done. The application of this simple device has saved two-thirds of the shipfitter's time ordinarily consumed in this operation.

As may be seen from the drawing below, this fixture can be used for a dual purpose. If the plate is buckled downward, it can be straightened by the following procedure: a clip is tacked to the plate; a hook on the fixture is attached to the clip; the plate is pulled upward to the stiffener. If the plate is straight or buckled upward, the fixture is merely used to position the stiffener against the plate.



Panel stiffener jig. It holds the stiffeners at right angles to the plate for tack welding.

Welding Cylinder Heads

By *J. S. WRIGHT*

ONE OF THE big problems confronting job welding shops throughout the winter is the repair of cracked cylinder blocks and heads. Aluminum heads are particularly tough jobs inasmuch as the usual practice is to dismantle the head and preheat it before arc welding.

In our shop, The Auto Hospital, Yonkers, N. Y., my two brothers, Ben and Elias, and myself have developed a process by which we can arc weld aluminum cylinder heads in place without dismantling or preheating. This greatly simplifies the task of repair.

To weld a cylinder head by our process requires two men: one welding while the other stands by with a bucket of cold water. The weldor uses a 5/32 in. coated aluminum electrode and a hot machine. He strikes an arc at one end of the crack, digs his electrode into the puddle and welds very rapidly towards the center. After weld metal has been deposited for about 1½ in., the arc is broken and the helper pours water on the weld. He continues to drench the weld as long as any steam will form.

The quick quench is the secret of the entire application. It prevents the heat from spreading into the cylinder head itself, thereby preventing strains from expansion and contraction and also preventing warpage. Since aluminum has a high rate of heat transmission, it does not react to quenching in the same way as do iron and steel. Hence the water will not crack the weld nor will it affect the hardness or brittleness.

FLAWLESS

THE MAGNAFLUX TEST, shown above in Tube Turns' laboratory, quickly reveals any hidden defects in the finished product.

Flawless welding fittings are even more essential than perfect pipe. For extreme velocities, high pressures, vibration, strain, corrosive wear are *most* destructive to piping systems where flow changes direction . . . *at the fittings!* Defective fittings can cause leakage, breakdowns, unnecessary maintenance and can disrupt imperative production schedules.

Tests to *insure* flawless fittings have been, are today and will be a permanent Tube Turns' policy.

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ARMY E NAVY M

TUBE-TURN

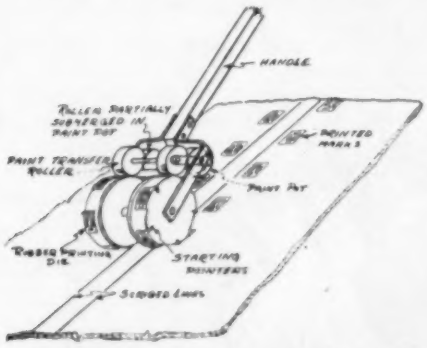
TRADE MARK

Welding Fittings and Flanges

Stagger-Weld Marker

By *GUY H. MOREHOUSE*

MARKING stagger-weld locations is generally somewhat of a slow, tedious job. I developed a machine for doing the work quickly and accurately and was subsequently awarded a prize by the War Production



Device for print-marking stagger welds. White or aluminum paint is employed for daylight use.

Drive Committee in the Richmond Shipyard No. 1, Richmond, Calif. As can be seen in the accompanying illustration, this machine is in many respects a movable printing press.

The old hand-measurement method of marking stagger-weld locations usually required from 5 to 7 minutes to mark a 20 ft seam. The stagger-weld marker makes it possible to mark a 20 ft seam in the time normally required to walk 20 ft, roughly 5 seconds.

The device is sight-guided along scribed lines on a plate. It prints uniformly spaced marks to indicate the proper positions of the stagger welds which will secure stiffeners or other beams to the plate. For daylight work, the marks are produced with white or aluminum paint, both easily visible through the weldor's lens. Hence there is no need for the weldor to raise his hood to ascertain where one weld stops and the next one begins. For night welding, it may be possible to use fluorescent paint that will glow under ultra-violet light. This, however, has not yet been tried up to the date of writing.

This device not only speeds up the marking of stagger welds but also prevents the welds from being extended beyond the necessary length because weldors are not able to see the marks clearly.

» «

Torch-Setting Gauge

By *HARRY SCHOENHAUT*

THE MACHINE flame-cutting of steel strips from plate stock always involves the problem of setting the torches to obtain strips of the desired width. Usually this operation is accomplished by setting the torch tips by eye, sighting through imaginary centers onto the edge of the scale. After spacing the torches, they are adjusted perpendicularly so as to place the tip the correct distance from the plate. The setting of the four torches of a multiple-torch machine usually requires half an hour or more by this method, and the results are varied. Furthermore, it is often necessary to set the torch several times in order to obtain the desired width of strip.

I designed a gauge (see bottom illustration) which makes it possible to set the torches in just three minutes. For this, I was awarded a prize by the Labor Management Committee of Richmond Shipyard No. 3, Richmond, Calif.

The gauge is adjustable for any torch set-up. It consists simply of a braced slotted bar which is clamped to the bed of the flame-cutting machine. On this bar are four sliding saddles which can be set in position to form an alignment rest for the torch. The torch is thus set quickly and accurately. Furthermore, it is held automatically in a perpendicular position at the right location.

» «

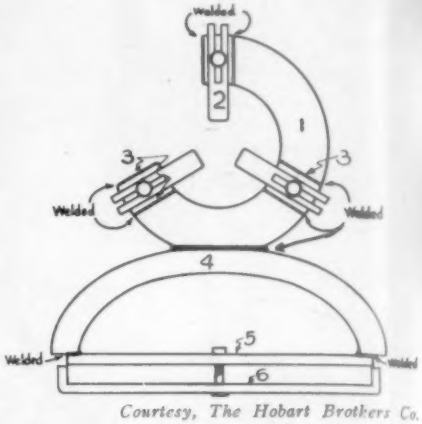
Steady Rest from Scrap

By *S. CRAIG CAIRNS*

IN THIS DAY of critical materials and tools, small welding and repair shops often find it impossible to procure the needed tools and equipment. Then it is time for ingenuity to be put to work. An example is provided by the Crivitz Repair Shop, Crivitz, Wis. Unable to buy a steady rest for their lathe, employees of this shop designed a rest of their own that was constructed entirely of discarded scrap. This was finished in a very short time and attached to the lathe.

This tool compares favorably with a factory-built steady rest, and the cash saving alone makes it a worthwhile project for any shop. As the steel used was discarded scrap, there was no material cost. Other costs—labor and preparing material for welding, cost of electrodes and power for the welder—all together did not amount to over $2.50. This steady rest, however, will handle practically any work that a factory one costing around $25 will handle. The sketch depicts the method of construction.

Materials needed and procedure: Flame-cut a circular ring (1) from a ⅜ in. plate. Upon completion of the flame-cutting operation, face one surface of the ring in a lathe. Bolt holes for the jaws should now be drilled and tapped; these are spaced



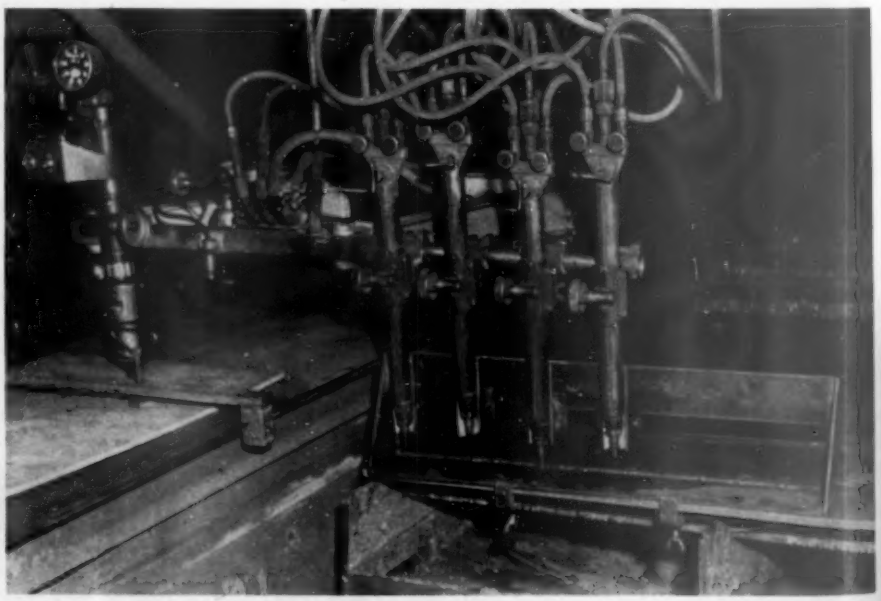
Courtesy, The Hobart Brothers Co.

This shop-made lathe steady rest permitted the machining of long pieces of pipe and other round stock which could not otherwise be handled. Explanation of the numbers is given in the text.

at 120 deg intervals. Grind a flat surface on the outer circumference diametrically opposite one of the bolt holes; this is for fastening the ring to the clamp. Cut an opening in one of the upper segments of the ring to allow for the entrance of material.

Make the three jaws (2) by slotting a piece of ¼ by 1 in. mild steel and harden the tips by an application of hard-facing material. The jaws are bolted to the ring as shown in the sketch. Six guides (3) are now made of ¼ by ¼ in. mild steel and are fitted snugly against each side of the jaws. The jaws are aligned so that their centerlines will intersect in the center of the ring, and the guides are then welded along the outside edges.

The bracket (4) is constructed of three pieces of ¼ by 1 in. mild steel. The two outer strips are bent edgewise and welded to the center strip so as to form a channel. Pieces 5 and 6 are of ½ by 1 in. mild steel. Piece 5 is welded to piece 4 as shown, while piece 6 is formed as indicated in the sketch.



Torch-setting gauge for multiple-torch flame-cutting machine that is being used to cut strips.

Save 75% of your Time and Material Cost with the use of Nelson Stud Welding Equipment

STUD USES

1. Securing wood decking
2. Securing hangers for wireways, single, double and multiple run
3. Securing hangers for pipe
4. Securing plastic armor
5. Securing plastic decking
6. Securing all types of insulation material
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8. Securing electric light fixtures and switch boxes
9. Securing gun mounts
10. Securing manhole covers
11. Securing furniture
12. Securing cargo battens
13. Securing degaussing trough covers
14. Drawing outer hull to template form
15. Drawing steel plate to conform to shape
16. Securing doubler plates
17. Securing treadplates
18. Spacing outer shell on uptakes
19. Reinforcing concrete
20. Securing scupper valves
21. Securing chains to buoys
22. Securing canvas weatherstripping
23. Securing parts to steel castings

Nelson Special Pointed and Flux Filled, All-Position Welding Studs are available in diameters of from 3-16" to 1-2", and in lengths from 1" to 8". Insulation Pins (with 1½" diameter head) are available in lengths determined by thickness of material to be secured.

Write for Samples, Catalog & Price List

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SPECIALTY WELDING EQUIPMENT CORP.

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EASTERN DISTRIBUTORS
CAMDEN STUD WELDING CORP.
CAMDEN, NEW JERSEY

ARMY E NAVY

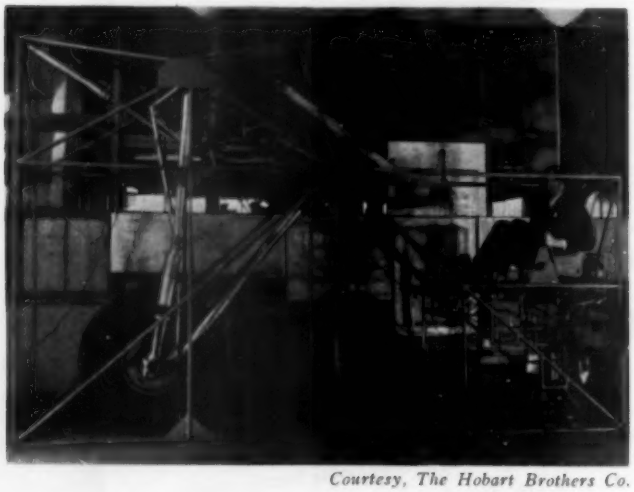
On the Job

Welded Aircraft Mock-up

By *HENRY CHASEN*

Instructor, New England Aircraft School

THE airplane landing gear mock-up shown in the picture below is used to train student flyers to operate the landing gear, bomb doors, wing flaps and brakes and to make various inspections. Replacing the airplane fuselage, the mock-up houses the landing wheel, hydraulic pumps, controls, tanks, pressure relief valves, etc. used on one of the Army's bombers. It may thus be thought of as being a sort of jig or fixture.



Courtesy, The Hobart Brothers Co.

Constructed by arc welding old boiler pipe, this hydraulic mock-up unit has since been copied by air schools in many parts of the country.

It became my job to construct this mock-up—in just 28 days as classes were to start almost immediately in this kind of instruction. Looking over the blueprints of the mock-up used by the Army school at Chanute field, I found to my surprise that 20-gauge chrome-moly (SAE 4130) aircraft tubing and practically all bolted joints were specified. (Some joints, constructed of aircraft-type fittings, were oxy-acetylene welded.) We estimated that this job would take about three months to construct with the limited facilities we had available. We simply had to find a shorter, less expensive way to do it.

Previously, we had obtained some 2,000 ft of old boiler pipe, from which we had fabricated many units such as propeller dollies, engine change work stands; stepladders, barrel dollies and airplane fuselage tail stands. Out of this second-hand boiler pipe, we now constructed the landing gear mock-up by arc welding. In order to conserve time, we used a poor fit-up electrode (AWS E-6012 class), thus eliminating the grinding and fitting of tube ends prior to welding. All main joints were reinforced with gussets of ¼ in. boiler plate.

The job was completed in just three weeks—a saving of 75% of the 12 weeks which would have been required for the construction of a mock-up to Army specifications. The estimated cost of the latter mock-up was $465; our cost was $229, a saving of 50.5%. The work was done by the students of the New England Aircraft School (Army Division) under my supervision.

» «

Car Parts from Scrap

ARC WELDING is making it possible to fabricate car parts from salvaged material in connection with a heavy freight car repair program at the Delaware and Hudson Railroad Corporation's car shops at Oneonta, N. Y. In order to overcome the effect of arc-blow, a-c welding is used extensively for welding in tight corners and at difficult angles.

Arc-blow is particularly troublesome when d-c welding is done inside a closed steel structure such as the combined center sill filler and back draft stop shown in the illustration below. This part is therefore fabricated by a-c welding from old channels, angles and plates. Although the operator must work in confined corners, the absence of arc-blow makes it possible to obtain the penetration required.

A-c welding is also being used for the salvage of pieces of center sills from the underframes of badly damaged cars. The serviceable pieces are straightened under large air-operated presses and joined by welding, reinforced by splice plates, to form full-length center sills.

» «

Ship Assembly Speeded

PATROL vessels to convoy troop and supply ships through submarine infested waters are coming from production lines just a little faster as the result of a suggestion which netted a $700 award to Herman Vander Nesse of Chicago.

Vander Nesse, an employe of the fabricating department of Pullman-Standard Car Mfg. Co., devised an arrangement for using clamps and levers to force a large ship plate over a form. Previously, the prescribed method had been to heat the plate in a furnace several times to shape it and in addition to spend 35 hours of torch heating on each pair of plates. Vander Nesse's suggestion saved well over a hundred man-hours per ship.

Courtesy, General Electric Co

Combined center filler and back draft stop being welded in Delaware and Hudson car shops.

How come he's checking up on welds?

THERE'S a simple reason. Repair a broken casting by bronze welding . . . and the quality of the weld metal is of vital interest to the man who machines the part to its final dimensions.

The machinist is only *one* of the many new men whose requirements may influence your welding practices. Chemists, safety experts, electrical engineers . . . they all may have a hand in setting the complex standards by which your weldments must be approved.

It may be worth-while to re-examine your welding rod selections and techniques in the light of these new requirements. If you want the advice of men who know bronze welding procedures from every service standpoint, just call the nearest Chase Sales Service Office. They are ready to help you with your welding problems—or to get the answers for you from Chase headquarters.

CHASE

CHASE BRASS & COPPER CO. *Incorporated,* **WATERBURY, CONNECTICUT**

Subsidiary of Kennecott Copper Corporation

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**Indicates Sales Office Only*

This is the Chase Network —handiest way to buy brass

Six-in-One Oil Tank

By *CHARLES C. LYNDE*

OBJECTIONS to holding standard oil drums at the job while their contents were being used led one contractor to acquire a number of the rectangular containers formerly used by service stations for dispensing bulk oil. Since each of these holds more than the capacity of the standard drum, it was easy to empty the drum and let it go back on the truck making the delivery. The trouble with the system, though, was that the containers were hard to keep in order and required an elaborate platform to stand properly. This difficulty was solved by the maintenance gang weldor, who fabricated a skid frame on which six square oil containers could be conveniently mounted.

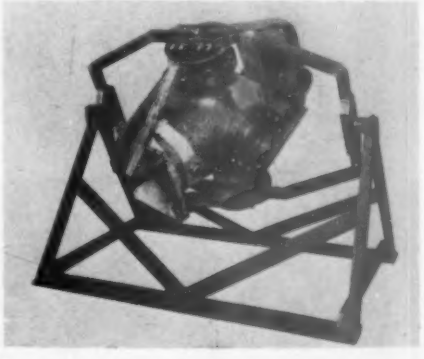
Six tanks were joined into a "unitized" container for lubricating oil by means of this pipe framework. A quarter was cut out of each of the four vertical corner pipes, which were welded so that the cut-away portions fitted over the tank corners. Tie members at the top keep the uprights from spreading apart and also strengthen the frame.

Junk pipe was used throughout for the construction of the framework combining the six separate tanks into a "unitized" oil container. In order to hold the tanks effectively, the weldor simply cut a quarter out of the four upright corner pipes and welded them in place so that the cut-away portions fitted over the tank corners. Tie members at the top prevented the uprights from spreading apart and releasing the tanks. The enclosing frame was sufficiently strong to permit drums to be rested on it while they were emptying into one of the six compartments.

» «

Gimbal Cuts Welding Time

AN OLD DEVICE long used for the suspension of ship compasses and chronometers has been successfully adapted for welding positioning. Foreman M. F. Waid, Erie Works, General Electric Co., made the gimbal shown in the accompanying illustration from salvaged bar stock; it consists, basically, of a pivoted ring in which a body can be supported to turn on an axis while the ring itself can be turned about an axis at right angles to the first.



Gimbal designed for positioning weldments at General Electric's Erie Works. Rotation around either of two axes at right angles to each other is made possible by this device.

Use of this gimbal is said to have cut by 50% the time previously required for welding certain miscellaneous parts. It is easy to set the work into the best welding position, and the liberal distances between frames assure a safe hand clearance.

THIS IS IT!

— CHEK-SHOCK Oxygen CUSHION Valve —

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will prevent unnecessary internal wear in regulator *(as, NOT necessary to release control screw before opening tank valve).*
- Will eliminate possible injury to operator from burstings.
- Will increase life of regulator assembly.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on *(this uncontrolled surge which strikes like a hammer, is the direct cause of most damaged regulators and accidents).* Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

ONLY ONE MOVING PART, POSITIVELY FOOLPROOF

PRICE IS LESS THAN ONE REPAIR BILL

Universal coupler type (will fit any oxygen regulator) . . . . . $6.00 each
Screw-in type (for removable inlet stem regulators only) . . . . $5.00 each

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Send orders with M. R. O. to

Safety Shock Manufacturing Co.
FOWLER, CALIFORNIA

HERCO ARC WELDERS

THE RESULT OF YEARS OF THE MOST EXACTING RESEARCH IN THE WELDING TRANSFORMER FIELD

PRECISION CONTROL

Variable Core construction permits stepless heat changes while welding. Magic Eye-Pilot indicates when machine is on.

STREAMLINED ARC

Instantly starting, smooth, flexible. Elimination of "arc blow" produces sound, speedy and uniform welds. X-Ray test beads.

LOWER COST

Power cost 50% lower than motor generators. No rotating parts at all, therefore supervision, oiling, replacement of wearing parts eliminated.

POWER FACTOR

corrected welders if desired.

MODELS

available from 150 to 2000 amperes.

OTHER PRODUCTS

Manufactured by Hercules
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MAGNETIC ALIGNERS
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HEAVY DUTY—
THREE PHASE SOLENOIDS
FOR AUTOMATIC SPOT WELDING

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Continuous 24 hour per day operation. Sturdy connectors, on-off switch or circuit breaker for lifetime of wear. Spun glass insulation.

Durable sheet-steel housing. Easy rolling, portable.

VC—250
(40 - 250 amps)

VC—375
(50 - 375 amps)

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MANUFACTURERS OF THE PRECISION WELDER WITH THE

STREAMLINED ARC

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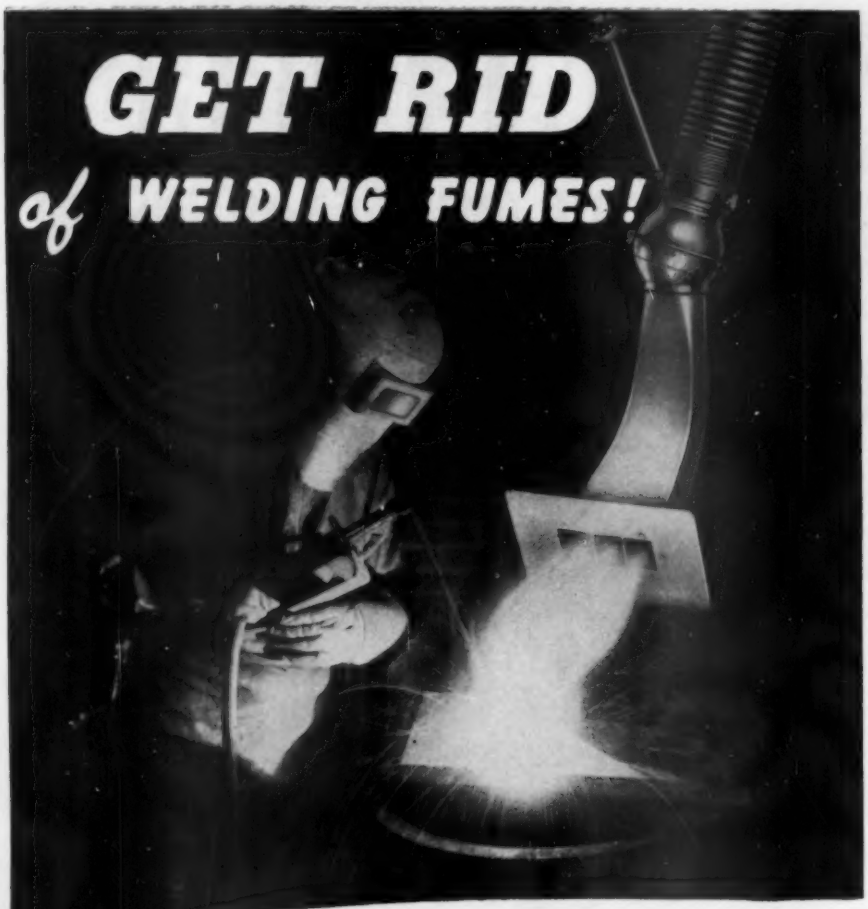

RUEMELIN FUME COLLECTORS draw Smoke and Heat Away at the SOURCE!

Now — Your fume problems can be solved quickly and efficiently by installing Ruemelin Fume Collectors. Powerful suction draws out noxious gases, smoke and heat *at the source.* Guards employee health, resulting in less welder fatigue, therefore greater plant output. Has many exclusive features: (1) Clears shop air with minimum loss of building heat. (2) Exhaust snout can be positioned instantly and conveniently. (3) Covers maximum welding territory, vertically, horizontally and by circle swing. (4) Shipped completely assembled, easy to install. More than 1,000 units serving war plants all over the nation. Write for Bulletin 37-C.

Also manufacturers of Sand Blast Equipment and Tubular Cloth Dust Filters. Ask for literature.

RUEMELIN MFG. CO.
3880 North Palmer Street
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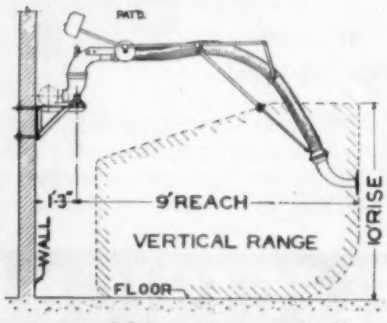
3 STANDARD REACHES:
3 ft., 9 ft., and 15 ft. radius.



Arm extended for maximum reach. Note unusually wide working range.

RUEMELIN
WELDING FUME COLLECTORS

A 4275-3/4

World's Biggest Dishes

GARGANTUA or any other famous giant of literature would have found "dishes" 15 ft in diameter a bit oversize, but the oil industry requires them. Weighing 34,370 lb, the elliptical dished head pictured below is one of four formed from welded plates by the Lukens Steel Co. for use in the construction of two petroleum reactors being built by The M. W. Kellogg Co.

One of four elliptical dished heads which measure 15 ft 2 in. OD and weigh approximately 34,370 lb each.

Flat circles 230 in. in diameter were needed for spinning the record-breaking heads. Such a width is beyond even the capacity of a 206 in. plate mill (world's largest), so pairs of plates 116 in. wide, 232 in. long and 2¾ in. thick were welded into 230 in. squares. The welding was done at the Jersey City plant of The M. W. Kellogg Co. in accordance with Paragraph W-451 of the API-ASME Code for Unfired Pressure Vessels for petroleum liquids and gases.

A flat circle of the required 230 in. diameter was flame-cut from each of the four squares, and these were shipped to Lukens at Coatesville, Pa. It was necessary to cut away part of the railroad car to let the giant discs clear overhead obstructions, and the heating furnaces in the Lukens plant also had to be enlarged. Five heating operations were required to convert the flat circles into dished heads.

The finished heads measure 15 ft 2 in. OD by 2¾ in. nominal gauge (2½ in. minimum after forming), 3 in. straight flange, 47¼ in. overall depth and 44¼ in. inside depth of dish. Their effect on petroleum output will be considerable.

HOW ABOUT sending us some of your own ideas for "On the Job"? Just a few words and a photograph will do the trick. Payment will be made at our usual rates. Address: Editorial Department, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5.

And *Another* Independent Mobile Oxygen Generator will be under way to a battlefront Air Field

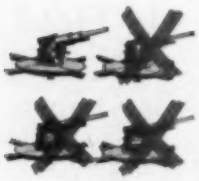
☆ The steady stream of Mobile Oxygen and Hydrogen producing plants going to the armed service is the result of long and accurate planning by Independent Engineers, *pioneer* manufacturers of this type of equipment. Mass production methods were early applied . . . another Independent "First" . . . and the constantly increasing volume of delivery is evidence of Independent's ability to serve efficiently, in war times, and in peace time.

Independent Engineering Co.

101 West Second Street, O'Fallon, Illinois

...with **X-RAY**

...the modern way to "know" what you're getting



A New England war plant, purchasing steel castings from an outside source, was experiencing a reject rate of 75% *after* machining. Each reject meant a loss of 3 machine and man-hours. Solution: X-ray inspection to "spot" defective castings *before* machining. Result: 100% real production from same men and machines . . . tremendous savings in materials. Another example of how Westinghouse X-ray takes the "guesswork" out of industrial inspection . . . speeds production and cuts costs.

J-02022

More Information? See page 6

Westinghouse X-RAY

Welded Grain Elevator

By *ROBERT ALLAWAY*

AN EXCELLENT example of how welding can be used to aid the farm front is provided by a grain elevator constructed for the Montana Agricultural Experiment Station Farm at Bozeman, Mont. Material used included an old car chassis, some 6 in.

Courtesy, The Hobart Brothers Co.

The conveyor pipe was an old well casing.

well casing, a piece of 4 in. steel pipe, some old radius rods and braces reclaimed from wornout cars and other pieces of scrap. The only new parts required were the gas engine, sprockets, chain and flights.

The 4 in. pipe was welded to the axles while the old radius rods were used for braces. The conveyor pipe was welded together from several pieces of smaller lengths. The grain hopper and the top and bottom boots were fabricated by cutting, shaping and welding small pieces.

The Rural Engineering Department of Montana Agricultural College assisted in the design.

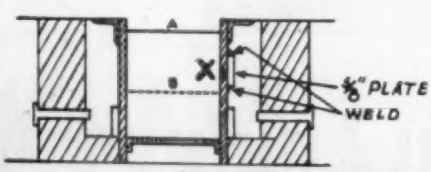
» «

Big Kettle Repaired

By *F. C. BRIGHTLY, JR.*

Standard Galvanizing Co.

THE GALVANIZING kettle depicted in the sketch failed at point "X." Rather than hold up production for days, we effected a temporary repair by welding. First, the molten zinc was bailed out to level "B" and the side wall opposite the leak removed in order to gain access to the outside of the kettle. An 8 by 8 by ⅝ in. plate was then welded on four sides over the leak, using ⅛ in. electrodes. When this patch was in place, the wall was rebuilt and the zinc restored to the kettle. This took 22 hours as against five days to install a new kettle. The cost of patching, including the labor of bailing out 20 tons of zinc, was approximately $200. The kettle operated four months with this repair and stayed in service until slackened production permitted its replacement.



Courtesy, Harnischfeger Corp.

"A" indicates normal zinc level, "B" zinc level during repair, "X" the point of failure.

"GENERAL" WELDING FUME EXHAUSTERS

For effective elimination of the *Noxious Fumes* from

Arc Welding

Galvanized Iron Soldering

Spray Painting, Etc.

TWO TO TEN INLETS—

For multiple hose connections in shop and field operations.

SINGLE INLET UNITS—

For exhaust from booth collector ducts; and in the smaller units.

High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses

SEMI-PORTABLES—

Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

PORTABLE "JUNIORS"—

40 to 100 pounds in weight; one or two inlet nozzles.

Self-closing caps on all nozzles.
Rugged, all-steel construction.
Motored for continuous service.
Controls protected within base.

Bulletin CB-103 gives specifications and dimensions for the 28 types and sizes comprising the "General" line.

GENERAL BLOWER CO.

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New York CHICAGO 22, ILL. Detroit
Pittsburgh Philadelphia Cleveland

FOR BEST RESULTS On "Poor Fit-Up" Jobs

Use Raco 8 Shielded Arc Electrodes

Bridging wide gaps in poorly fitted joints is work just "made" for Raco 8's, because these Electrodes are versatile. They produce excellent multiple pass, high tensile medium ductility welds in all positions. Furthermore, though Raco 8 Electrodes give best results with direct current, straight polarity, satisfactory welds can be made with reverse polarity and with alternating current. Try Raco 8 Electrodes on *your* "Poor Fit-Ups." You'll be rewarded with faster, better production, lower costs.

Raco 8 Electrodes comply with all these specifications:

A.W.S.—A.S.T.M. Specification A233-42T, Type E-6012.

A.S.M.E. Boiler Code, Para. U-70.

American Bureau of Shipping, Grades H1G and B2G (A.C. or D.C.)

Dept. of Commerce, Bureau of Marine Inspection and Navigation.

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Use Raco 82 Electrodes for building up worn parts and surfaces of medium-carbon steel. Welds are machineable.

The REID-AVERY COMPANY

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TO
Speed Deliveries
OF
VITRIFIED WHEELS

Vitrified Bonded Wheels are very much in the Cortland production picture — and the Circular Continuous Tunnel Kiln shown here is a step toward better delivery on this type of grinding wheel, in sizes of 16″ and smaller. You can depend upon Cortland for quality — and for better deliveries than ever before when you want them.

* * *

Resinoid Bonded Wheels in all standard sizes for weld grinding are available for the usual prompt shipment.

CORTLAND GRINDING WHEELS CORP.
15 CORTLAND STREET, CHESTER, MASS.

CORTLAND
GRINDING WHEELS

Do You Agree?

If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

Oxygen Purity Effects

Q—It is said that the purity of oxygen is quite important in flame-cutting operations. Is there anything to this statement? —*W. R.*

A—Yes, a good deal. Flame-cutting tests which have been made on steels of various thicknesses with oxygen of various purities show that: (1) if the purity of the oxygen falls below 88% it will not support combustion sufficiently to cut steel and (2) that a 0.5% increase in the purity of oxygen from 99.0% to 99.5% pure oxygen will result in an average saving of from 10 to 15% in both time and oxygen.

» «

Flame-Priming

Q—What is flame-priming?—*A. B. J.*

A—Flame-priming is a process of flame-cleaning steel surfaces using an especially designed wide-flame torch. This torch has a series of closely spaced ports for high velocity oxy-acetylene flames. Cleaning is accomplished by the high temperature and velocity of these flames, which tend to remove (by loosening through thermal expansion) all mill scale, rust and other imperfections that are not too tightly bonded. In addition, the physically absorbed and chemically combined water is at the same time driven from any rust present, leaving stable oxides in its place. The flames also disintegrate other contaminates such as oil and acid salts.

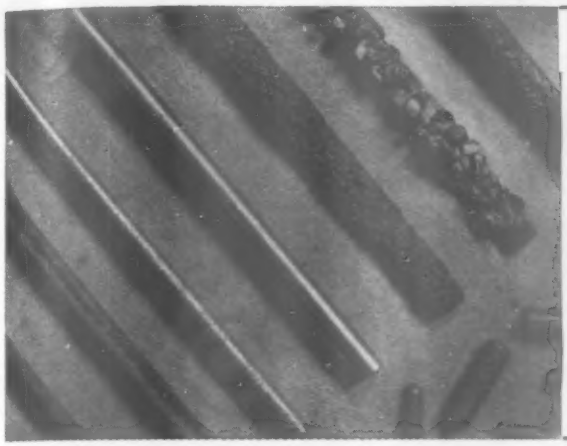
» «

Open Circuit Voltage

Q—What is open circuit voltage?—*V. T. B.*

A—Open circuit voltage is the term usually applied to the voltage measured across the termination of a welding generator under no-load conditions. In welding operations, experience has shown that when the open circuit voltage is at least double the arc voltage the arc will be more stable, easier to maintain without interruption and less likely to be affected by magnetic conditions, adverse air currents or vapors rising from the work. It is also found that when the open circuit voltage is too low it is difficult to start the arc and maintain it. This is particularly true when low open circuit voltages are involved. For ordinary welding operations, ordinary circuit voltages should not be much below 50 or 60 volts. Even higher voltages are desired for certain welding conditions.

HAYNES STELLITE RODS—*For Every Type of Hard-Facing Application*



What Hard-Facing Is — Hard-facing is the process of welding on to wearing parts a protective coating, edge, or point of a hard metal. This procedure makes critical parts of machines and equipment last from 2 to 25 times longer. Haynes Stellite Company has a rod for every type of hard-facing application.

Types of Rod Available

Stellite Rod — the original non-ferrous cobalt-chromium-tungsten hard-facing alloy — available in three different grades — high in "red hardness," highly resistant to abrasion and corrosion — applied by oxy-acetylene or electric-arc process.

Hascrome Rod — iron-base hard-facing rod containing chromium and manganese — work-hardens under impact — applied by oxy-acetylene or electric-arc process.

Stellite "93" Rod—iron-base hard-facing alloy containing more than 40 per cent of alloy ingredients — hard and abrasion resistant — applied by oxy-acetylene or electric-arc process.

Haystellite Inserts — cast tungsten carbide in 13 standard shapes and sizes — extremely resistant to abrasion — generally applied by oxy-acetylene process with high-strength steel rod as binder.

Haystellite Tube Rod — tungsten carbide grains of 9 standard screen sizes in high-strength steel tubes—extremely wear-resistant —applied as hard-facing rod, generally by oxy-acetylene process.

Haystellite Composite Rod — tungsten carbide grains of 4 standard screen sizes distributed in high-strength steel binder — extremely wear-resistant — applied as hard-facing rod, generally by oxy-acetylene process.

Write for descriptive price lists of Haynes Stellite hard-facing materials.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite" are registered trade-marks of Haynes Stellite Company.

IT'S *Quicker* TO USE A

CMD *Triple Duty*

CHIPPING HAMMER

Triple Duty
TYPE CB

3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.

This convenient tool has a chisel in one end of the head and a drift in the other and a removable wire brush on the end of the handle. The user does not have to set aside the rod holder to chip or brush away slag from the weld. This model is one of many in the CMD line famous for quality for 22 years. Write Department 11W for latest circular for complete details.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY

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OF SUPERIORITY

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary with "York's 77".
3. Chipping is unnecessary with "York's 77". A satisfactory bond is always guaranteed.
4. Deteriorated cast iron can be welded with "York's 77".

YORK'S 77 CAST IRON BRAZING FLUX

YORK ENGINEERING COMPANY

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Brazing Cast Iron Pipe

Q—We are contemplating the laying of a cast iron pipe line through brackish swamp land. Cast iron pipe will be used because it is available, also it is believed to have superior corrosion resisting qualities in this soil. Originally, we planned to join the sections with a cast iron filler metal, but we have been advised to braze this line instead. Should we? If so, why? Our weldors can produce excellent cast iron welds.—*H. E. P.*

A—Brazing is undoubtedly the proper means of joining cast iron pipe for the job you have outlined. It is practically impossible in any welding operation to produce weld metal which is of exactly the same structure as the parent metal being welded. This means, of course, that if the welded structure is exposed to an electrolyte such as a very wet, mucky, soil, brackish water or sea water, galvanic currents will be set up which will attack that portion of the structure which is anodic. Galvanic action of this type becomes serious only when the positive or anodic portion of the structure is small in area as compared to the cathodic part. For example, in the brazing of two iron pipes the joint is cathodic and corrosion takes place on the pipe. Since corrosion is spread out over a relatively large area, it is not usually severe at any one point. For this reason, brazed joints in cast iron pipe present no serious corrosion problems.

If a cast iron fusion weld is made with cast iron rods, the weld metal is distinctly anodic to the rest of the pipe. Under favorable conditions, the galvanic corrosion might easily cause failure through a concentrated attack upon the weld. This condition may be avoided if the electrodes are of an alloy cast iron such as nickel, nickel-chromium or molybdenum cast iron. Since the weld metal then becomes cathodic to the pipe wall, no problem from a corrosion standpoint exists.

» «

Flame-Hardening Depth

Q—Is it possible to control the depth of hardening in a flame-hardening operation? —*J. A. T.*

A—The depth of hardness in flame-hardening is controlled by the speed of travel of the flame. The slower the hardening flame travels over the work the greater is the depth of hardness. This is natural inasmuch as a slower traveling flame stays in one spot longer and consequently heats the metal to a greater depth. The drastic action of quenching also affects the metal temper, resulting in hardness to a varying depth. This, however, is not so easy to control as the flame travel.

» «

Carbon Content of Steel

Q—What is meant when it is said that steel contains 35 points of carbon?—*G. H. M.*

A—When steel is said to contain 35 points of carbon, it merely means that the carbon content is 0.35% (35/100 of 1%). A point is a term frequently used in metallurgy to indicate 1/100 of 1%.

Get this new aid

THAT HELPS IDENTIFY WELDING TROUBLES

New trainees learn to spot faulty welding procedures faster... "old hands" can increase their efficiency... with the help of this new 24-page book. By stressing accurate visual inspection, it helps boost both weld quality and quantity.

Each of the 14 most common welding troubles is illustrated with a typical "good" and "bad" example; causes are analyzed; and specific suggestions for cure are outlined.

The book is pocket-size—ideal for plant distribution. Welders can take it home to read or keep it handy on the job.

It's a helpful trouble shooter for problems like splatter, corrosion, undercutting and brittle joints. Order a copy of this booklet for each of your welders today.

This same information is also made available by Westinghouse in chart form for wall mounting. Write for free copies of booklet B-3326 and chart DC-250 on your company letterhead. Please state exact quantities required. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-90497-1

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

WELDERS, ELECTRODES AND ACCESSORIES

New Products to Use

Welder Control Dial

★ General Electric d-c welders of the **Type WD-30** series are now equipped with two new control dials which permit

One dial is calibrated in terms of electrode sizes on this improved line of d-c arc welders.

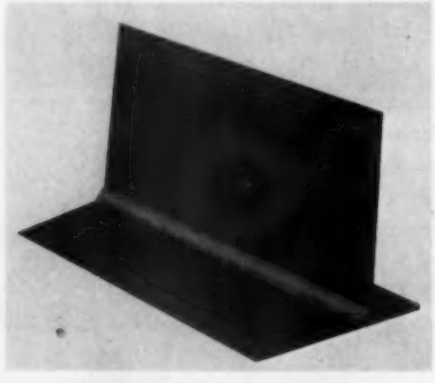
the welding current to be preset, without the aid of a volt-ammeter. One of the control dials is calibrated directly in terms of electrode sizes (see illustration) and is simply set to correspond to the size of the electrode being used. The other dial indicates the range of welding current available and is set by rotating a pointer to whatever amperage the operator wishes.

These welders also have a redesigned driving motor that is equipped with heavier insulation and special weather-protective features. While basically the same as the motor previously furnished, the new driving motor has been designed to give exceptional resistance to outdoor weather conditions. Electric Welding Div., **General Electric Co.**, Schenectady, N. Y.

» «

All-Purpose Electrode

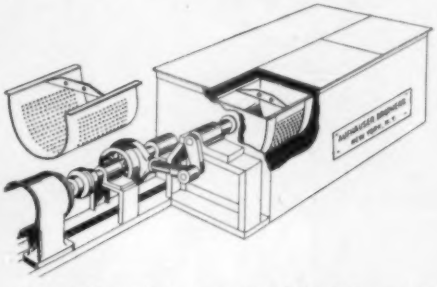
★ **"Fleetweld 37"** is a new general purpose electrode for welding mild steel. It may be used in all positions and with either alternating or direct current. Advantages, states manufacturer, are: easy



Fillet joint welded with "Fleetweld 37," a new all-position, general purpose electrode for mild steel.

striking; smooth operation; no slag interference when welding vertical down; the ability to withstand higher currents, making possible higher welding speeds. Physical properties are: tensile strength, 70,000 to 80,000 psi; yield strength, 60,000 to 68,000 psi; ductility (elongation in 2 in.), 18 to 25%.

Fleetweld 37 conforms to AWS classifications E-6012, E-6013, E-7011 and E-7012. It is available in ⅛, 5/32 and 3/16 in. diameters in 14 in. lengths. **The Lincoln Electric Co.**, Cleveland.



Scrap rod washer. One set of baskets can be loaded during the time the other set is operating.

Rod Washer

★ The **Aufhauser rod washer** was specifically designed to facilitate the salvage and reclamation of scrap welding rods. The rods are handled without bending through exchangeable baskets, which speed up loading and unloading. Two sets of baskets are included—four for 14 in. rods, two for 18 in. rods. The machine is capable of continuous 24 hr service if necessary, states manufacturer. Design details and blueprints are available to concerns who wish to build their own rod washers. **Aufhauser Brothers Co.**, 295 Madison Ave., New York City.

» «

Dust Collector

★ **Model 1250 "Dustkop"** is a portable, self-contained unit for collecting dust from flexible shaft grinding or lint and dirt from buffing and polishing operations. A horizontal baffle spreads the suction of the air and catches heavier pieces of work or tools, etc., which may have been accidentally dropped through the grill. The heavier dust and dirt drop down through a funnel to the bottom of the stack and are removed through a hand-hole clean-out. The lighter dust travels on into a cyclone separator, is separated from the air and drops into a glass storage jar. The air is then further cleansed by passing it through a spun glass filter before it recirculates. Capacity of this model is 1,200 cfm of air at velocities upwards of 4,500 fpm. **Aget-Detroit Co.**, 602 First National Bank Bldg., Ann Arbor, Mich.

All-Weather A-C Welder

★ Wilson **"Bumblebee"** a-c welders have been made available in new All-Weather models of 300 and 500 amp capacities.

All-Weather "Bumblebee" a-c welder. Besides moisture-proof insulation and protective paint it is equipped with a new low voltage contactor.

These machines, although similar to the standard Bumblebee welders, are featured by special moisture-proof insulation and a heavy coating of moisture-proof paint to protect exposed parts. The outer case is also equipped with gaskets and louvers designed to prevent the entrance of rain.

Another new feature of the All-Weather model is a low voltage contactor which automatically holds the open circuit voltage at approximately 40 volts. This becomes operative when the arc is struck, and the performance of the welding transformer thereafter equals that of machines not similarly equipped. When the arc is extinguished, the low voltage contactor immediately reduces the open circuit voltage to 40 v. **Wilson Welder and Metals Co., Inc.**, 60 East 42nd St., New York City 17.

» «

Magnetic Comparator

★ This new device was designed to provide a rapid means of quality control for ferrous parts of the same size and shape. The part to be tested is placed in a coil which has been balanced electrically against a standard part also within a coil. Any difference in the two parts—which may be caused by wrong composition, improper heat treatment, or a variation of hardness, size or other properties—affects the magnetic flux linking the coils surrounding the parts and hence shows up as unbalance on the comparator's indicating instrument. Contrariwise, the instrument reads within passing limits when the tested part is acceptable. The comparator is sufficient-

(Please turn to page 73)

Spot and Seam Welding of Low Carbon Steel*

THE DATA shown on the accompanying charts were compiled by canvassing approximately 60 fabricators of mild steel structures and resistance welding equipment manufacturers. It is the best information available at this time for low carbon steel spot and seam welding, and is recommended as standard practice during the war emergency.

The work was initiated by the Resistance Welding Research Committee of the Welding Research Council and has been approved by the Resistance Welding Standards Committee of the American Welding Society.

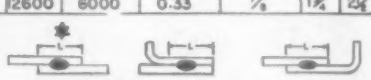
The data were compiled for mild steel (SAE-1010) for thicknesses up to 0.125 in. The Standardization Subcommittee will publish at a later date welding data on high carbon steels (such as X4130) and heavier gauges of mild steel.

The information in the charts is arranged in the order in which a welding operator or supervisor would set up a welding machine. For instance, after the metal gauge is determined, the welding electrode or roll is selected, the pressure is adjusted, the weld time is then set and a pull test made. This is the order in which the data appear from left to right on the welding charts.

Spot Welding Data: Two forms of electrodes were suggested by several manufacturers. One is the type shown at the top of the column entitled "Electrode Diameter and Shape" in Table I. The other was a straight electrode with dome-type tip with a 2½ in. radius. We have shown the former because it was used more currently, but both types are acceptable provided the diameter of the contact surface (d) is held to the values indicated. The large diameter of the electrode (D) is a minimum; a diameter less than that indicated will cause excessive "mushrooming" of the tips.

Table I. Recommendations for Spot Welding

Thickness of Thinnest Outside Piece "T" Inches	Gage	Minimum Electrode Dia. & Shape d Inches	D	Net Electrode Force Pounds	Weld Time Cycles (60 per second)	Approx. Current Amperes	Minimum Weld Strength Pounds	Approximate Diameter of Fused Zone Inches	Minimum Overlap * "L" Inches	Minimum Weld Spacing ℄ to ℄ Inches 2 "T"	3 "T"
0.010	32	1/16	3/16	200	4	4000	200	0.10	3/16	1/4	1/4
0.020	26	3/16	3/16	300	6	5500	450	0.13	7/16	5/16	5/16
0.030	22	3/16	3/16	400	8	7000	800	0.16	1/16	1/2	3/4
0.040	20	1/4	1/2	500	10	8000	1200	0.19	1/2	3/4	1
0.050	18	1/4	1/2	650	12	9000	1750	0.22	9/16	7/8	1 1/8
0.060	16	1/4	1/2	800	14	9600	2300	0.25	5/16	1	1 3/8
0.080	14	5/16	5/16	1100	17	10800	3450	0.29	11/16	1 1/8	1 1/8
0.094	13	5/16	5/16	1300	20	11500	4250	0.31	3/4	1 1/8	1 3/4
0.109	12	3/8	3/4	1600	23	12000	5200	0.32	7/8	1 3/8	2
0.125	11	3/8	3/4	1800	26	12600	6000	0.33	1/8	1 3/4	2 1/8



Notes:

1. *Type of steel, SAE 1010*
2. *Material free from grease, scale and dirt.*
3. *Data for total thickness of pile-up not exceeding 3 "T."*
4. *Minimum spacing is that spacing for which no special precautions need be taken to compensate for shunted current effect of adjacent welds.*
5. *Thickness of thinnest outside pieces determines welding conditions.*
6. *Electrode material:*
   Minimum conductivity—75% of copper.
   Minimum hardness—75 B Rockwell.
7. *Strengths shown for highly stressed structures.*

Net electrode force refers to the exact force between contact surfaces.

Welding current is given approximately to help specify and calculate the capacity of welding machines. It should not be used as an exact value to obtain a given weld strength.

Minimum weld strength, as explained in footnote 7, Table I, is that strength which should be obtained for highly stressed structures. A simple pull test in a reliable testing machine with the samples unconfined is the accepted method of checking this value. For structures with a high inherent factor of safety, the minimum strength indicated could be reduced approximately 30 per cent. Recommended test metal sizes are given under Army Air Corps specification No. 20011-C.

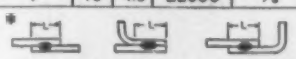
Diameter of fused zone data should be helpful if cross-sectional etch tests are made to check penetration of the weld in the outside thicknesses.

Minimum lap indicates the required overlap as shown in the sketches at the bottom of the chart. It is extremely inportant not to go below the values shown, otherwise the weld will be too small and difficult to maintain under shop conditions.

Spacing is indicated for twice the thickness of the thinnest outside piece (2"T") and three times the thickness of the thinnest outside piece (3"T"). As explained in footnote 4, Table I, minimum spacing is that distance for which no special precautions need to be taken to compensate for the shunted current effect of adjacent welds. This shunted current effect is greater for heavier pile-ups hence the increased spacing for 3"T."

Table II. Recommendations for Seam Welding

Thickness of Thinnest Outside Piece "T" Inches	Gage	Roll Width & Shape d	D	Net Roll Force Pounds	On Time Cycles (60 per second)	Recommended Off Time (Pressure Tight) Cycles	Max. Weld Speed Inches per Minute	Welds per Inch	Approximate Current Amperes	Minimum Overlap * "L" Inches
0.010	32	3/16	1/4	400	2	1	80	15	8000	3/16
0.020	26	3/16	3/16	550	2	2	75	12	11000	3/16
0.030	22	1/4	1/2	700	3	2	72	10	13000	1/2
0.040	20	1/4	1/2	900	3	3	67	9	15000	1/2
0.050	18	3/8	1/2	1050	4	3	65	8	16500	9/16
0.060	16	3/8	1/2	1200	4	4	63	7	17500	5/8
0.080	14	3/8	3/4	1500	6	5	55	6	19000	11/16
0.094	13	7/16	3/8	1700	7	6	50	5.5	20000	3/4
0.109	12	1/2	3/4	1950	9	6	48	5	21000	3/4
0.125	11	1/2	3/4	2200	11	7	45	4.5	22000	7/8

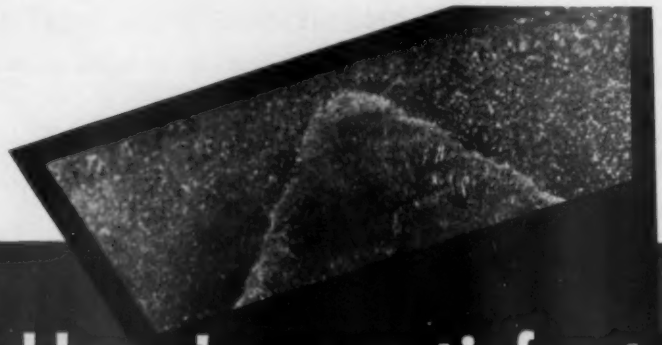


1. *Type of steel, SAE 1010*
2. *Material free from grease, scale and dirt.*
3. *Data for total thickness of pile-up not exceeding 3 "T."*
4. *Weld strength with welds per inch as shown approximately 85% strength of parent metal.*
5. *Thickness of thinnest outside pieces determines welding conditions.*
6. *Roll material:*
   Minimum conductivity—75% of copper.
   Minimum hardness—75 B Rockwell.

Seam Welding Data: The data on this chart, Table II, are intended for pressure-tight seam welding, and therefore welding roll width instead of electrode diameter is indicated.

"On times" and "off times" are the times during which the current is flowing and interrupted. If a slower welding speed is necessary, the "off time" should be increased, rather than increase the number of welds per inch. A greater number of welds per inch than those values indicated results in excessive heat input; this might tax the equipment unnecessarily and cause undue distortion of the work.

*From "Recommended Practice for the Spot and Seam Welding of Low Carbon Steel—An AWS Emergency Standard" published by the American Welding Society.



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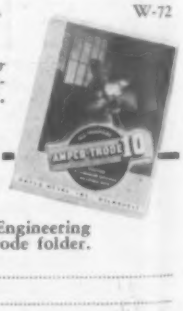


AMPCO METAL, INC.
Dept. WE-2, Milwaukee 4, Wisconsin

Please send Ampco-Trode 10 Bulletin, Engineering Data Sheet 107, and general Ampco-Trode folder.

Name..... Position.....

Company.....

Address.....

City..... (.....) State.....

New Products

(Continued from page 70)

G-E magnetic comparator. It provides a non-destructive test for ferrous parts to make certain that each part has the required properties of hardness, composition, size, etc.

ly sensitive, it is claimed, to detect a difference of as little as two points Rockwell when hardness difference is the sole variable being tested.

The comparator consists of a variable-voltage transformer, a sensitivity control rheostat, coarse and fine balance control rheostats and the required capacitors. All of these are mounted within a portable steel case. Coils are available in a variety of sizes. Special Products Div., **General Electric Co.**, Schenectady, N. Y.

» «

Plastic grinding shield. It has a non-shatterable glass window and lamps set flush with the frame to throw the proper amount of light upon the work.

Grinder Shield

★ A new model **Marvel grinding shield** of impact-resisting plastic with a window of non-shatterable glass is offered to provide both protection against flying particles and properly directed light, set to focus on the work. The bayonet-type lamps are vibration resisting and are inset flush with the frame. **The Boyer-Campbell Co.**, 6540 Antoine St., Detroit.

» «

Table-Type Printers

★ Blue prints or direct process black-and-white prints up to 44 in. wide and any length may be produced with the new **"B-1"** and **"B-2"** table-type continuous printers. These printers are portable and can be placed on any convenient table or bench and plugged into any standard outlet. Cooper-Hewitt mercury vapor tube lamps are used. **Peck and Harvey**, 4237 Addison St., Chicago.

Die and Cutting Tool Costs Reduced *with Amsco Dieweld*

Amsco Dieweld is conserving strategic steels and reducing costs for forge shops, metal stamping plants and other users of dies, punches, shears, shoes and cutting tools.

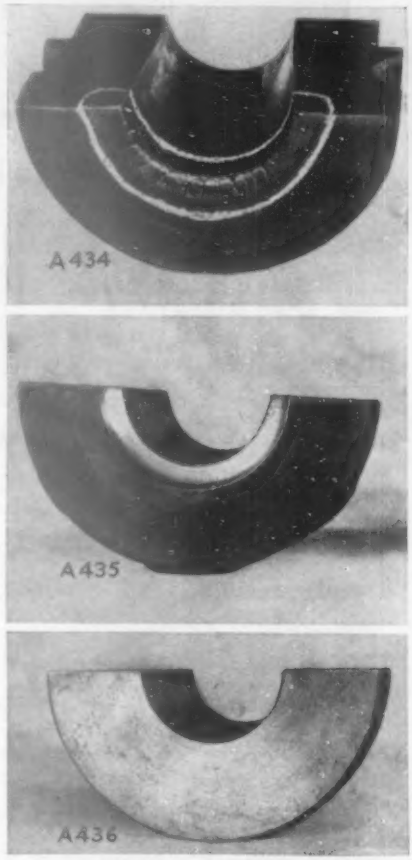
Dieweld, a welding tool steel of unusual character, was developed for the salvaging of dies and tools. This chrome-moly-carbon alloy can be applied to all ferrous metals. It is air-hardening as deposited, and may be softened through proper heat treatment for machinability and rehardened within a desirable range.

The deposited metal has the combined characteristics of hardness with unusual toughness, and the ability to retain a keen cutting edge plus resistance to wear and abrasion in both hot and cold work. Unusual savings have been made with Dieweld by greatly increasing the life of expensive metal cutting and forming tools.

Forging dies, composed of a carbon steel base with Dieweld cutting edges, have outworn several sets of ordinary dies. Cold forming equipment, reconditioned with this material, gave double the number of impressions previously obtained before tolerance limits were reached.

A large upset forging producer, who ran 18,000 to 20,000 forgings from a set of hot working dies before repairs were necessary, ran 29,800 (over 56% more) forgings from the same dies after restoring with Dieweld as shown in pictures A-434 (as worn), A-435 (with worn portion cut away), and A-436 (as welded and machined, ready for use).

Ask for Bulletin 742-W, which contains complete information on Dieweld, including directions for softening deposits for machining and subsequently hardening for service.



A-434. This upset forging die became checked after producing 18,000 to 20,000 pieces.

A-435. Die is shown machined and ready for application of Dieweld.

A-436. Die welded and machined. This salvaged die produced 29,800 forgings, or over 56% more than before restoration with Dieweld.

Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
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15%-30% more production with the WILSON "BUMBLEBEE"

Here's why the Wilson AC welding machine is boosting welding output by 15% to 30% in many metal-working plants. The "Bumblebee" puts a real sting into the arc – makes it deep and penetrating and almost wholly free of "arc blow". As a result welding output is notably increased while weld quality is considerably improved.

In addition, the "Bumblebee" reduces power costs – using 30% to 35% less power to do the same amount of work as an equivalent DC machine. Built-in capacitors provide improved power factor, which helps to reduce power bills, and permits operation of more welders from existing shop lines without causing overload. Maintenance, too, is easier because the "Bumblebee" has no heavy rotating parts.

The Wilson "Bumblebee" is made in 300 and 500 ampere capacities. Special running gear assembly can be supplied (at slight extra cost) where portability is desired. The "Bumblebee" is also made in "All-Weather" models which have extra moisture protection throughout, as well as automatic low open-circuit voltage controls.

Other Wilson AC welders are available in sizes from 100 to 1000 amperes capacity. There is a complete line of Wilson AC electrodes for every AC welding requirement.

WILSON

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Gasoline-Driven Welders

★A line of portable gasoline-driven d-c welders is announced by the **Libby Welding Co.**, 2700 East 14th St., Kansas City 1, Mo. These assemblies are made up of Waukesha, Allis-Chalmers, Willys-

Portable d-c welder for locations where electric power is not available.

Overland jeep or Ford motors with either Lincoln or P&H welding generators. The assembled unit with tool box is mounted on a welded structural shape chassis equipped with rubber tires and a towing attachment. The machine can be moved by hand on the job. Total weight is approximately 1,500 lb, and the base measure measures 72 by 22½ in. Its low center of gravity renders this welder particularly suitable for work in rough terrain.

Lens Holder

★Highlighting a new line of welding helmets being introduced by Chicago Eye Shield Co. is a "lift front" lens

Streamlined "lift front" lens holder. All pockets and cavities have been eliminated from the outer surface.

holder. Besides opening the full 90 deg in the conventional manner, this new holder may be used in a semiopen position which affords the weldor a clear view of his work yet protects him from harmful flashes. Light leakage is impossible, states manufacturer, since intermeshing beaded surfaces assure a positive blackout of light rays. The changing of lenses is facilitated by simplified lens springs and a reduced spring tension. **Chicago Eye Shield Co.**, 2303 Warren Blvd., Chicago 12.

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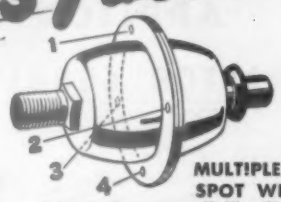
4 Times Faster



PROJECTION WELDING SAVES CLEVELAND FIRM 75% WELDING TIME

Instead of welding 4 individual spots on this welded job the older way, Harris Products Co., Cleveland manufacturers of vibration insulators, installed a special projection welding die, making it possible to speed production by 4 times the former rate. Perhaps you, too, can profit by adapting projection welding techniques to your work and by using the improved Model J Spot and Projection Welders. Designed for general work, these models contain several new features not found in resistance welders selling for far greater prices. Write today, telling us your problem. We will offer our best possible help at no obligation.

MULTIPLE SPOT WELDING

sketched above on a Muffler Shock Insulator Assembly, made possible a welding rate 4 times greater than could have been reached by individual welds. A special die designed to weld points 1, 2, 3, and 4 (above) at one contact made this possible. The older way would have been to weld point 1, turn the piece, weld point 2, turn the piece again, etc.

PROJECTION WELDING ON UNIVERSAL WELDERS

is a more efficient way to meet schedules. You get more uniform welds from these rugged, simply constructed welders. Use current economically. "Green help" produces uniformly good welds with the Model J Spot Welder.

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Please send new catalog, giving full details and prices on Universal Spot Welders and your full line of equipment and accessories.
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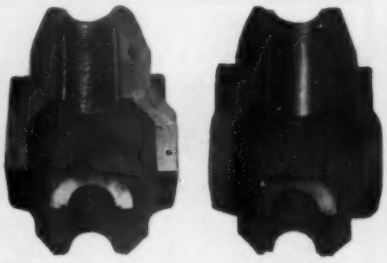
Yes

Our customers make machinable Arc Welds on CAST IRON



Before machining — After machining

After being welded with PHILLIPS "600" Electrode this cast iron housing was machined through the fusion zone.

This book tells what procedure is best for your cast iron welding.

Send for your copy TODAY

PHILLIPS "600" Electrode, a non-ferrous, flux-coated rod, produces deposits that are of the color of cast iron and are *fully machinable through the line of fusion.* It can be used in all positions with A.C. or D.C. and maintains a steady and quiet arc without excessive spatter. This electrode is salvaging many valuable castings daily in hundreds of foundries and machine shops. Complete procedure information is contained in our 12-page book on "4 Ways to Salvage, Reclaim and Conserve Iron Castings by Electric Arc Welding." A copy is yours for the asking.

C. C. PHILLIPS & COMPANY

2750 Poplar Street
Detroit 8, Michigan
332 So. Jefferson Street
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MANUFACTURERS AND DISTRIBUTORS OF WELDING ELECTRODES AND SPECIALTIES

MANGANAL

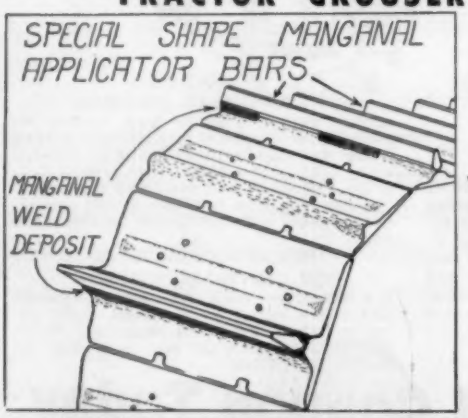
(Reg. U. S. Pat. Office. U. S. Patents 1,876,738—1,947,167—2,021,945)

SPECIAL SHAPE

APPLICATOR BARS

FOR

TRACTOR GROUSER RE-TREADS



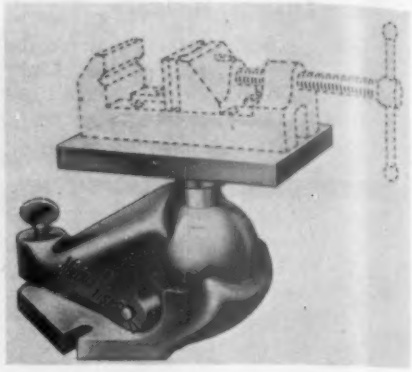
MADE IN FIVE SIZES EASILY WELDED TO ANY SHAPE OR SIZE GROUSER. PROVIDES A RE-TREAD FOR ALL TRACK LAYING TYPES OF EQUIPMENT.

Attach with Manganal Bare or Special Tite Kote welding electrodes.
Applicator bars are manganese nickel steel, the toughest metal known. Work hardens under impact and abrasion.
New parts are difficult to obtain. Saves approximately 80% of the metal of a new part, as well as time and money.

150 Distributors Are Ready to Serve You
Sole Producers

STULZ-SICKLES COMPANY

134-142 Lafayette St., Newark, N. J.
Try Seaco Hard Surfacing Over Manganese Weld Deposits



Small-size positioner. The dotted outline indicates how vise may be fastened to the face plate for holding work.

Vise Positioner

★ The **Metro positioner** is offered in two standard sizes: 7¼ in. high with an 8 by 11 in. face plate and 5¾ in. high with a 4 by 11 in. plate. A vise or fixture may be bolted or fastened to the face plate, as indicated by the dotted outline in the accompanying illustration; work clamped in the vise can then be tilted at any desired angle for such operations as welding, checking, milling, drilling, shaping, boring, filing, etc. The positioner, operating on the ball-and-socket principle, is quickly released or locked by a thumb screw. **Metro-Vise Co.**, 245 Stephenson Bldg., Detroit 2.

» «

Twin Dipmaster. It speeds up metal cleaning, degreasing and rustproofing operations.

Dip Tank Combination

★ With two hot-liquid dip tanks in one portable unit, the **Twin Dipmaster** speeds metal-cleaning operations by eliminating the necessity of transporting metal parts and products to a separate tank for hot or cold rinsing. Each compartment has a removable electric heating element and a separate thermostat, assuring any required temperature from 110 to 550 F. **Aeroil Burner Co., Inc.** Park Ave. at 57th St., West New York, N. J.

« »

Metal Marking Machine

★ This new machine was designed for the marking of flat and cylindrical parts for instruments and binoculars. Instead of the customary engraving and filling, a hot pressure process is used to apply pigment or metallic color. **The Acromark Co.**, 9-13 Morrell St., Elizabeth, N. J.

P&H
— AC — ARC WELDERS

WELD
from 15% to 30%
FASTER!

14 MODELS CAPACITIES UP TO 1200 AMPS

Swifter Production

Liberal capacity permits use of larger electrodes. Easier control of molten pool enables you to weld from 15 to 30% faster—makes shorter work of all kinds of jobs, including intricate, close-corner welding.

Easier Operation

Micromatic adjustment gives you an infinite number of settings. One single creep-proof control provides stable current that "stays put" where you want it.

WSR (Welding Service Range) Ratings

Every model carries a WSR rating plate which specifies actual *usable* welding range from minimum to maximum. There's no guesswork.

Greater Values

Quality-built to last for years. No rotating parts to wear. Maintenance costs are practically eliminated. Write for complete information on P&H A. C. Arc Welders. Models up to 1200 amperes capacity. *Ask also about* P&H *Electrodes for A. C. Welding.*

P&H is America's only manufacturer providing a complete welding service including A. C. and D. C. Arc Welders, Welding Electrodes, Welding Positioners, Electric Hoists, Overhead Cranes, Etc. Write for Literature.

Gen. Offices: 4513 W. National Ave., Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

ARC WELDERS • EXCAVATORS • ELECTRIC CRANES P&H MOTORS • HOISTS • WELDING ELECTRODES

Canadian Distribution: The Canadian Fairbanks-Morse Co., Ltd.

News of the Industry

MacQuigg Presented 1943 Morehead Medal

Charles Ellison MacQuigg, dean of the School of Engineering, Ohio State University, was presented with the James Turner Morehead Medal for the year 1943 during a formal dinner of the International Acetylene Association, held January 24 at the Union League Club, New York City. The medal was awarded to Dean MacQuigg for "advancing the oxy-acetylene processes through metallurgical research and for leadership in welding engineering education."

During over thirty years in numerous types of metallurgical activities, Mr. MacQuigg has had a part in extensive research and development work on welds and materials for welding. He was long the guiding force of the Tests and Specifications Committee of the Compressed Gas Manufacturers Association in the testing and development of cylinders for transportation of oxygen, acetylene, and other compressed gases. Pioneer work under his direction, specifically in developing high-strength steel, bronze, and stainless steel rods for oxy-acetylene welding, has served as a foundation for many recent researches.

In engineering education, Mr. MacQuigg holds an equally prominent place. Shortly after accepting his present position, he was instrumental in developing and establishing at Ohio State University the first (and still the only) complete four-year curriculum in welding engineering, leading to a baccalaureate degree in this subject. Prior to his appointment as Dean of the College of Engineering at Ohio State University in 1938, he was manager of Union Carbide and Carbon Research Laboratories, Inc. Before beginning his services with that corporation in 1919, he was for five years head of the Department of Metallurgy at Pennsylvania State College.

» «

Bending Machine Cuts Down Welding

A right-angled steel structure can be fabricated either by making a corner weld on two flat plates or by bending one flat plate into a right angle. Heretofore, the second method has been of relatively minor importance because of the difficulties involved in bending any but thin gauges of steel. Recently, however, the bending method has been adopted to supplement welding in the production of gear cases for 226 new Victory ships. According to Westinghouse engineers on this job, bending has eliminated 50 miles of welding and saved 180,000 man-hours of skilled weldors' time and 360,000 lb of electrodes.

A bending machine is utilized to form the heavy steel plate into right angles. The bent plates are then joined by welding. The previous method had been to build the gear cases by welding, one piece at a time, from the ground up. Now there are seven distinct subassemblies—four for the base and three for the cover.

» «

Safety Services Offered to "Small" Organizations

A new membership service designed exclusively to fit the needs of industrial organizations with 100 employees or less was announced recently by the National Safety Council. The small-unit memberships will include an annual safety manual, supplies of accident prevention charts and safety inspection check lists, monthly poster service, master copy of a monthly safety letter to employees, monthly issue of a safety instruction poster and a full year's subscription to *National Safety News*. Inquiries should be directed to the National Safety Council, 20 N. Wacker Drive, Chicago 6.

WE WANT TO TALK TO THE *man from missouri*

about how MARQUETTE REGISTERED U.S. PAT. OFFICE FEATURES *Cut Cost* AND *Speed Production*

From coast to coast MARQUETTE maintains a corps of factory trained welding experts to demonstrate to you in your own plant, on your own work—without obligation—how these outstanding machines can bring you a new concept of welding speed, quality and economy.

These men offer another MARQUETTE "plus value." Being constantly in the field they can keep you abreast of the latest developments and applications of welding. They are always available for consultation and advice on any welding problem, bringing you the latest in the cost and time saving possibilities of this modern technique. This "follow-thru" is free of cost to MARQUETTE users.

Buy the Best . . . Buy Marquette for

LOW INITIAL COST • LOW COST OPERATION • NEGLIGIBLE UPKEEP
INSTANTANEOUS HEAT SELECTION • ALL ASBESTOS INSULATION •
AUTOMATIC VOLTAGE CONTROL • NO "MAGNETIC BLOW" • COMPLETE EQUIPMENT • 10 Models, 125 to 400 Amps.

Send for free, 24 page, illustrated booklet.

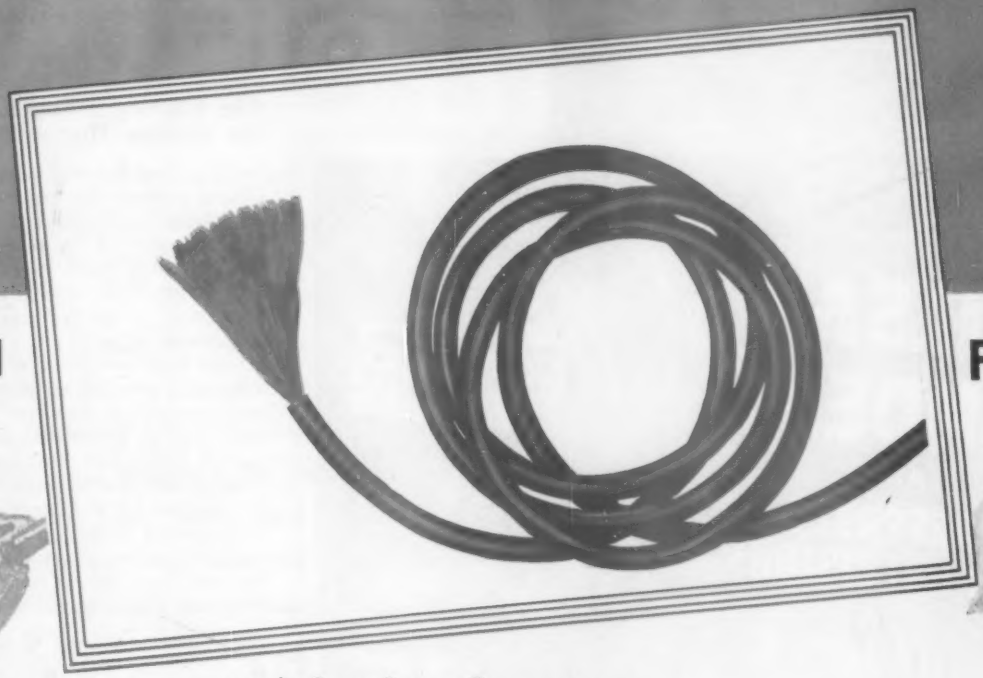
MARQUETTE MFG. CO., INC.
Minneapolis, Minnesota

MARQUETTE *a.c. arc welders*

SAVE SAVE SAVE

TIME LABOR MONEY

ON PRODUCTION WELDING OPERATIONS



TOUGH

as a

MARINE

FLEXIBLE

as a

BALLET DANCER

with the famous

BURDOX *Extra-Flex* WELDING CABLE

TOUGH JACKET—with heavy, live rubber protects wires, withstands abusive treatment.

FLEXIBLE—extra "stretchability" makes cable coil readily and easily.

LARGE NUMBER OF WIRES—of bright copper of hair-width sizes, properly wound, and separated from outer rubber by protective wrapping of heavy tape.

LONG LIFE—is assured by use of finest materials and expert workmanship.

LOW PRICED—yet performance equals that of many cables in higher price ranges.

Write for the new Burdett catalog which gives complete specifications on Extra-Flex Welding Cables, as well as description of other outstanding Burdox Welding and Cutting Products.

Millions of feet of Burdox Extra-Flex Welding Cable are serving under *today's conditions:* in ship yards, aircraft plants, in hundreds of war plants turning out water materiel, where time and labor-saving features are vital.

Burdox Extra-Flex Cable promotes faster production because it has greater resistance to wear, and holds its shape better under the destructive actions of oil and water. Tough, yet flexible, it's specially engineered to meet the exacting demands of high-speed welding operations. The copper conductor of Extra-Flex Cable is composed of thousands of tiny wires which allow the cable to coil readily and easily. These wires are properly wound and separated from a tough jacket of heavy, live rubber by a wrapping of heavy tape. Order a supply of Extra-Flex Cable today. It is handled in sizes from 6 to 4/0 by distributors and welding supply houses throughout the United States.

63% TO 155% MORE RESISTANCE TO ABRASION!

An actual test made by pulling four competitive makes of cable over a round surface covered with heavy emery cloth. Cable was pulled back and forth at the rate of twenty cycles per minute until insulation was worn through. Extra-Flex Cable outlasted the others by ratios of 63% to 155%.

HOLDS ITS SHAPE ⅙ TO ⅓ BETTER!

Cables were immersed in oil for periods of seven and fourteen days. They were then taken out and the increase in cable diameter due to swelling was measured. Extra-Flex Cable showed far less distortion than any other makes tested.

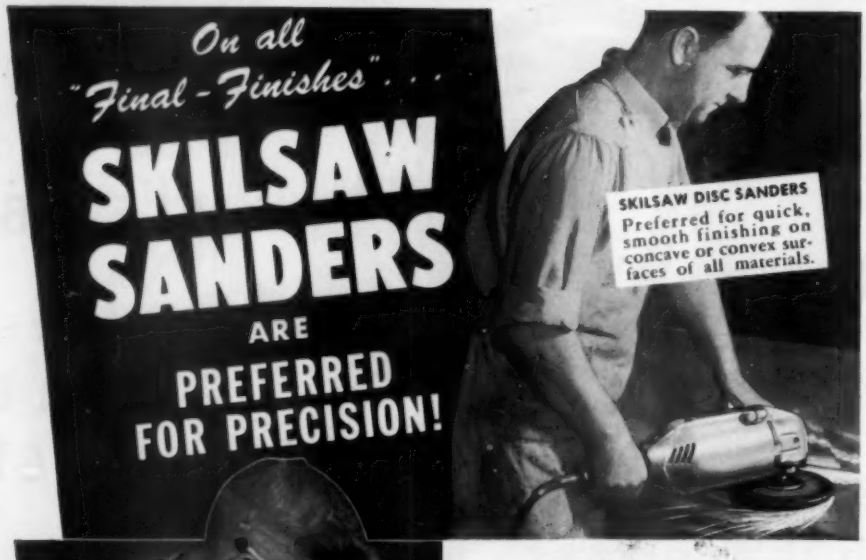
If you have a proper priority, and your local distributor cannot offer you prompt shipment, send us his name and address, and we will arrange to meet your needs to your satisfaction.

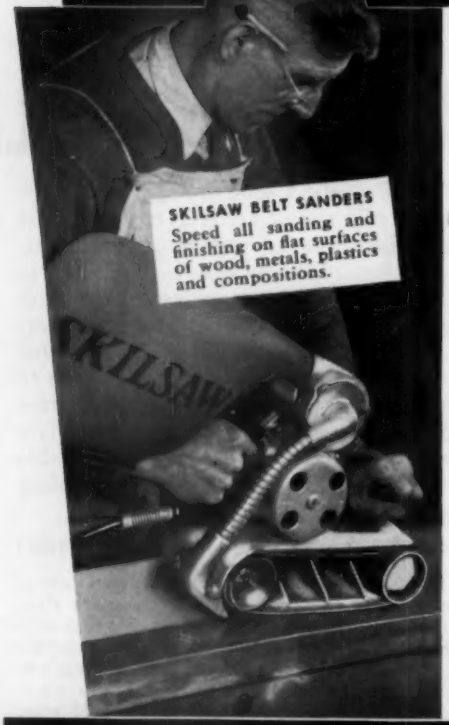
NOTE: *Good territories still open to responsible distributors.*

THE BURDETT OXYGEN COMPANY

3300 LAKESIDE AVENUE • CLEVELAND, OHIO

Mrs. Elsie Roberts, who handles a flame-cutting torch for Lukens Steel Co., took the job when her husband left the same plant to fight for Uncle Sam. She recently represented the steel industry in a pageant staged during the annual convention of the National Association of Manufacturers.


On all "Final-Finishes" . . .
SKILSAW SANDERS
ARE
PREFERRED FOR PRECISION!
SKILSAW DISC SANDERS
Preferred for quick, smooth finishing on concave or convex surfaces of all materials.


SKILSAW BELT SANDERS
Speed all sanding and finishing on flat surfaces of wood, metals, plastics and compositions.
SKILSAW

Whatever your surfacing jobs may be, there's a SKILSAW SANDER to do them easier, better, *faster!* For sanding, buffing or polishing flat surfaces, use SKILSAW BELT SANDERS. They are light, perfectly balanced and powerful for easy handling, fine workmanship and peak production. On concave or convex surfaces, SKILSAW DISC SANDERS are the tools you need . . . grinding down raised welds, cleaning metals, filing, sanding or polishing.

Ask your distributor to demonstrate SKILSAW SANDERS in your shop. He'll recommend just the tool you need . . . and he'll prove its value in time, money and manpower saved. *Phone him today!*

SKILSAW, INC.
4763 Winnemac Ave.,
Chicago 30, Ill.

Sales and Service Branches in All Principal Cities

SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

Welding Distributors Ass'n. Has Headquarters at Detroit

The Welding Distributors Association, a newly organized national organization, has now established headquarters at 12393 East Warren Avenue, Detroit 13. H. R. Lamy has been appointed executive secretary, with offices at the headquarters address.

The Association has held several meetings of its board of directors for the purpose of formulating policies. The last of these meetings was on December 8th in New York City.

» «

She Carries a Torch for Soldier Husband

Mrs. Elsie Roberts, who wields a flame-cutting torch in the open hearth department of Lukens Steel Co., Coatesville, Pa., was recently selected to represent the entire steel industry in a pageant, "Women in War Work," presented during the annual convention of the National Association of Manufacturers.

Steel is in the blood of this 25-year-old wife and mother. Her father was a Lukens employee and so was her husband until he was called by Uncle Sam last spring. Four months after her husband had left the soaking pits for the army, Mrs. Roberts applied for a job at Lukens and was assigned to the cutting of scrap. Even though she has two baby girls, one and three years old, she puts in a full 48 hour week, working the 8 a.m. to 4 p.m. shift

» «

Pressure Vessel Weldors in Critical Occupations

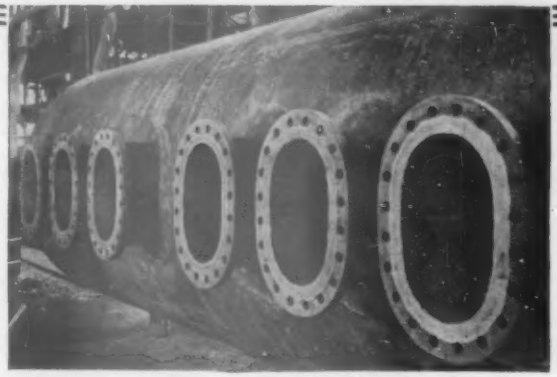
The job of electric arc weldor and high pressure vessel and piping weldor has been added to the list of critical occupations, the War Manpower Commission announced last month. However, the only persons included under this title are those who "use an electric welding apparatus in welding metal parts in the fabricating, erecting, or repairing of pressure vessels of carbon or alloy steel fabricated in conformance with codes of the American Society of Mechanical Engineers and the American Petroleum Institute." Weldors working on any pressure vessels that do not bear the official stamps of approval of the American Society of Mechanical Engineers are not included.

» «

Eutectic Welding Alloys Publishing House Organ

Volume 1, Number 1 of a new house magazine, *The Eutectic Welder*, made its appearance last month to some 30,000 industrial firms. The publication will be issued monthly by the Eutectic Welding Alloys Co., New York City, for the dissemination of information on low-temperature welding. It will be devoted to welding news, design, metallurgy methods, useful tools, helpful hints, etc. Mildred E. Laume is editor while R. D. Wasserman and A. F. Reedy are technical advisers.

RESISTS CORROSION AT ALL POINTS OF CONTACT



Fractionating tower, fabricated by Edge Moor Iron Wks., Inc. Diameter 6', overall length 43'6", top 15'6", section of Monel-clad 22/32" plate, cladding ⅛". Manways and covers also lined with ⅛" Monel, plug welded.

IN many important applications, the overlaying of Monel on steel permits maintaining continuous corrosion-resistant surfaces.

For example, in fabricating this fractionating tower of Lukens Monel-Clad steel plate, it enabled the manufacturer to protect the steel flanges with corrosion-resisting Monel. Thus, every part of the equipment which comes into contact with the harsh distillates resists their corrosive action.

Steel flanges are overlaid with Monel, first, by undercutting them 5/32" to 3/16" for a width of 1" or more, depending on the size of flange involved.

The first weld layer is deposited with ⅛" or 5/32" dia. No. 130X Monel electrode using string beads. Weaving is to be avoided because this technique makes a larger weld puddle . . . permits a higher percentage of iron to be diffused into the weld metal . . . lowers its corrosion resistance. Similarly, excessive penetration should also be avoided.

Suggested joint design, nozzle lining to sheet lining overlaying flange faces.

All flux should be removed from the first layer before depositing. Subsequent layers which may be laid down with a weave to produce beads up to ½" wide. Larger electrodes, 3/16" or ¼", may now be used.

Monel overlays made with No. 130X electrodes on mild steel have a hardness of 150 to 160 Brinell (3000 kg.).

For full information on welding Monel, write for Bulletin T-2, "Welding, Brazing and Soft Soldering of Monel, Nickel and Inconel." The International Nickel Company, Inc., 67 Wall Street, New York, N. Y.

★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

Compressed Gas Mfgrs. Meet at Waldorf-Astoria

How compressed gases are helping to win the war was told in detail during the 31st annual meeting of the Compressed Gas Manufacturers' Association, held January 24-25 at the Waldorf-Astoria, New York City. Among speakers and their subjects were: Colonel W. Randolph Lovelace II, chief, Aero Medical Laboratory, AAF, "Research in High Altitude Flying"; Daniel Mapes, Walter Kidde & Co., "Fire Extinguishing and Safety from Cylinders in War"; Harry A. Campbell, chief inspector, Bureau of Explosives, "Handling of Dangerous Articles during the War"; A. H. Moore, General Electric Co., "Electronic Control as Applied to Industry" and Captain E. V. Rupp, Matériel Command, AAF, "Supplying Oxygen in Military Aircraft."

» «

Ransome Positioners at Worthington Pump

Heavy demands for welding positioners have made essential the establishment of easier ordering and service information facilities, according to Charles E. Wilson, vice-president of Worthington Pump and Machinery Corp., which recently acquired the Ransome Machinery Co. As a step in this direction, Ransome welding positioning equipment is now more widely available to industry through the Worthington district offices in principal cities.

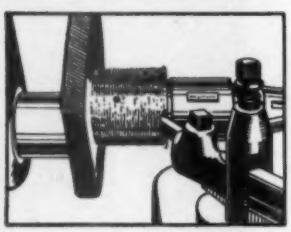
New Metal Surfaces Made by Spraying

Molten metal is now sprayed or atomized on to metal surfaces for the purpose of salvaging worn bearings, shafts, cylinder walls and such parts. Metallizing, as the process is called, is also used for putting a non-corrosive coating on iron or steel surfaces subject to corrosion such as cylinder walls of internal combustion engines, valve gates and such parts in contact with water. The metals to be sprayed may be aluminum, zinc, stainless steel, high carbon steel or other alloys depending upon the character of the surface desired. The sprayed surface may be "over built" and machined down to size to obtain accurate surfaces.

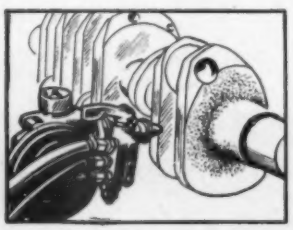
Metal spraying guns have been perfected for use with various types of gases for heat, depending upon the melting temperature of the metal to be sprayed.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information from The Metallizing Company of America, 1330 W. Congress St., Chicago, Illinois.



Rough threading—cooling locks metal firmly to surface, producing a permanently tight bond.



Sprayed journal before finishing—Main bearing journal after surface has been Metallized.

Y-101

ABOUT PEOPLE

J. L. Fosnight, president of the Us Electric Welder Corp., Toledo, Ohio, celebrated his 25th year in the electric arc-welding industry on January 4th. "I have watched this industry grow and become one of the most important industries in America," he says. "In the pioneering days, I give due credit for welding progress to our American railroads, one of the first industries to adopt and accept arc welding. With regard to the future, it is my belief that we have only uncovered around 20% of the possible arc-welding applications."

» «

B. J. Brugge has been appointed welding engineer in the Detroit office of the Lincoln Electric Company. He has been associated with Lincoln since 1931, serving successively in the Los Angeles, Houston and Washington offices. In 1935 he was granted a leave of absence to serve as welding superintendent for the Anglo-Iranian Oil Co. at Iran, Persia. Here he directed the training of many Persians in the art of welding. During the past two years, Mr. Brugge helped to develop armor plate welding, working with Army Ordnance at the Aberdeen Proving Grounds.

» «

Lorenzo Kennon, formerly consulting engineer at Willys-Overland, Inc., has gone into business as an independent consulting engineer with offices at 2436 West Central Ave., Toledo 6. He will specialize in mechanical and welding engineering problems pertaining to arc, gas, atomic-hydrogen, automatic and resistance welding.

» «

Gene Wedereit has been appointed advertising manager of Tube Turns and the Girdler Corp., Louisville, Ky. Mr. Wedereit, who was formerly vice-president and director of creative service of the E. F. Schmidt Co., Milwaukee, came to Louisville as a result of his work in the designing and production of Tube Turns' 240-page catalog. **Walter Girdler, Jr.,** who was formerly advertising manager, is now director of personnel.

» «

Lee Bergstrom has been appointed Los Angeles representative of Joseph T. Ryerson & Son, Inc. Mr. Bergstrom is also one of the owners of the Bergstrom Alloys Corp., Reno, Nevada, producer of hard-facing alloys.

» «

J. F. Bechtle has joined the Standard Steel Corp., Los Angeles, as assistant general manager. He was formerly connected with the metallurgical and research department of the M. W. Kellogg Co. in New York City and was associated with the development of welding and "Pluramelt."

Official U. S. Navy Photographs

THE *"Water Buffalo"* AND N-A-X HIGH TENSILE

N-A-X HIGH TENSILE is extensively used in the construction of the new LVT (2)—Landing Vehicle Tracked—to *reduce weight* and *still provide the strength and stamina* that equipment of this kind must have to meet the critical test of modern amphibious warfare.

Known as the "Water Buffalo," the LVT (2), designed, engineered and manufactured by Food Machinery Corporation, is a rugged amphibious vehicle which is highly maneuverable—on land, in swamps, and in the water.

At Tarawa, and more recently in the New Britain landings, amphibious vehicles such as these proved invaluable in surmounting obstacles in the water and gaining objectives ashore.

Great numbers of LVT's will be needed to carry out operations in all theaters of war—and large tonnages of N-A-X HIGH TENSILE will be needed to help build this equipment, but when the Victory is won, this outstanding steel will be used to build modern light-weight transportation equipment, as well as countless other products in which weight-reduction and strength will be important.

Buy Bonds and Help Speed Victory:

GREAT LAKES STEEL CORPORATION

DETROIT, MICHIGAN

Sales Offices in Principal Cities

Division of **NATIONAL STEEL CORPORATION** *Executive Offices, Pittsburgh, Pa.*

DUCTILITY
ITS INHERENTLY FINER GRAIN MAKES ALL THE DIFFERENCE
STRENGTH

Grant Davis has been appointed sales manager of Standard Steel Corp., Los Angeles manufacturer of construction equipment. Mr. Davis was formerly general sales manager of the shovel and crane division of the Lima Locomotive Works, Lima, O.

» «

Roy E. Ward and **Frank W. Maynard** have been named vice-presidents of the Austin Co. Mr. Ward is district manager at Los Angeles and Mr. Maynard district manager at Oakland, Calif.

» «

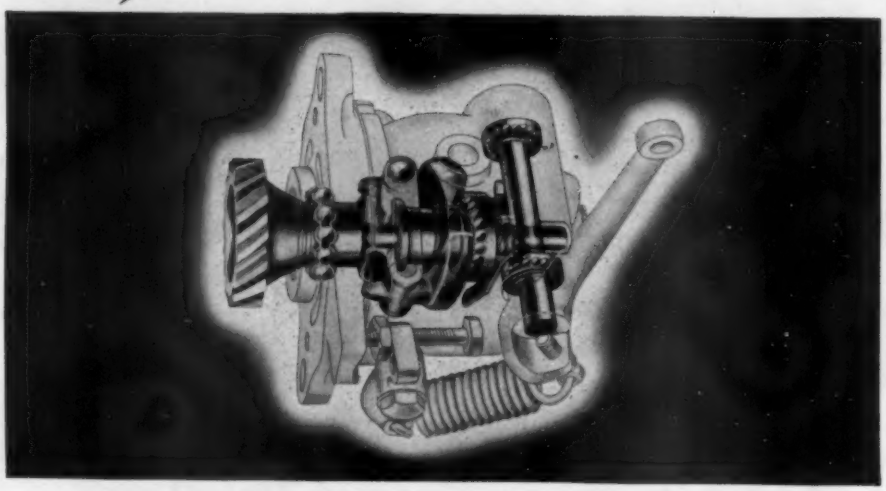
Leon R. Ludwig, formerly head of the circuit breaker and protective devices division of Westinghouse Electric and Mfg. Co., has been named manager of the company's motor division. Mr. Ludwig assisted in the development of the ignitron tube, widely used in resistance welding.

» «

R. L. W. Hawkins, for the past year on leave to serve as chief of the Arc Welding Section of the War Production Board, is back with Harnischfeger Corp. He is now associated with the P&H branch office in Chicago as welding engineer. Formerly, Mr. Hawkins was assistant sales manager of the company's welder and electrode division in Milwaukee.

Rely on Pierce

for Safe, Sure Welds!



HOW TO MAKE YOUR GOVERNORS LAST!

Like others manufacturing for war needs, Pierce production is for war and essential industry. For this reason new governors can be supplied only on a priority basis. But Pierce calls attention to these easy measures which will make your present Pierce Governors last and give the best service.

- **CLEAN GOVERNORS** once a month with kerosene, gasoline, or prepared cleaner.
- **INSPECT AND CHECK GOVERNORS** each week when in continuous operation.
- **CHECK OIL LEVEL** every day in manually lubricated governors. SAE 20 Oil is recommended at this time of year.
- **LINE UP** driving pulleys or gears accurately when reassembling governor after cleaning.

Should your governor need repair or reconditioning send it to the factory with the necessary preference rating certificate.

● Pierce Governor's time-proven flyball design provides simple, mechanical operation that is positive and unfailing . . . giving close, sensitive regulation necessary for perfect welds.

Their action is positive . . . mechanically efficient . . . assuring *complete* recovery of current characteristics within 3/10 second after striking arc.

To be sure of the weld . . . be sure the governor is Pierce. Manufacturers of precision governors, Pierce will give you the maximum of service life and satisfaction.

THE PIERCE GOVERNOR COMPANY, Inc.
1607 OHIO AVENUE • ANDERSON, INDIANA
Manufacturers of Pierce Precision Governors and Sisson Automatic Chokes

Pierce Governors
STANDARD SINCE 1913

F. N. Keithley has been appointed district engineer of the thermit department, South San Francisco branch, of the Metal & Thermit Corp. He has been engaged in sales and service work on the west coast since 1922 for Metal & Thermit.

» «

Alexander Leith, Jr., and **Alfred A. Lawrence** have been made district managers for newly opened sales offices of The Dow Chemical Co. Mr. Leith will head the Philadelphia office at 1400 S. Penn Square and Mr. Lawrence the New England office at 20 Providence St., Boston.

» «

E. L. Berry and **Richard F. Bergmann** have been elected vice-presidents of the Link-Belt Co., Chicago. Mr. Bergmann is chief engineer of Link-Belt and Mr. Berry is vice-president and general manager of the Link-Belt Ordnance Co. **John E. Martin,** who has been assistant to Brigadier General G. M. Wells of the War Department since Pearl Harbor, has been appointed manager of the Link-Belt Ordnance Co.

» «

Marvin G. Sedam has been appointed director of research for the Alloy Rods Co., York, Pa. He was formerly associated with the Harnischfeger Corp., Milwaukee, as chief metallurgist in charge of welding rod research and development.

» «

Bruce W. Bennett, formerly manager of sales of the Wilkes-Barre office, has been appointed assistant general manager of sales of the American Steel & Wire Co., subsidiary of the U. S. Steel Corp. He will be in charge of the New York office, succeeding **Frederick Connell,** who is retiring after 45 years with the wire company.

» «

James Dalton Cunningham, president of the Republic Flow Meters Co., Chicago, was recently elected to the board of directors of the Allis-Chalmers Mfg. Co.

» «

Died

Henry E. Miller, president of the Chicago Wheel & Mfg. Co., died at his Chicago home on January 10 after a brief illness. He was 80 years old. Mr. Miller had been president of his firm since 1895 and was also one of the founders of the Grinding Wheel Manufacturers Association.

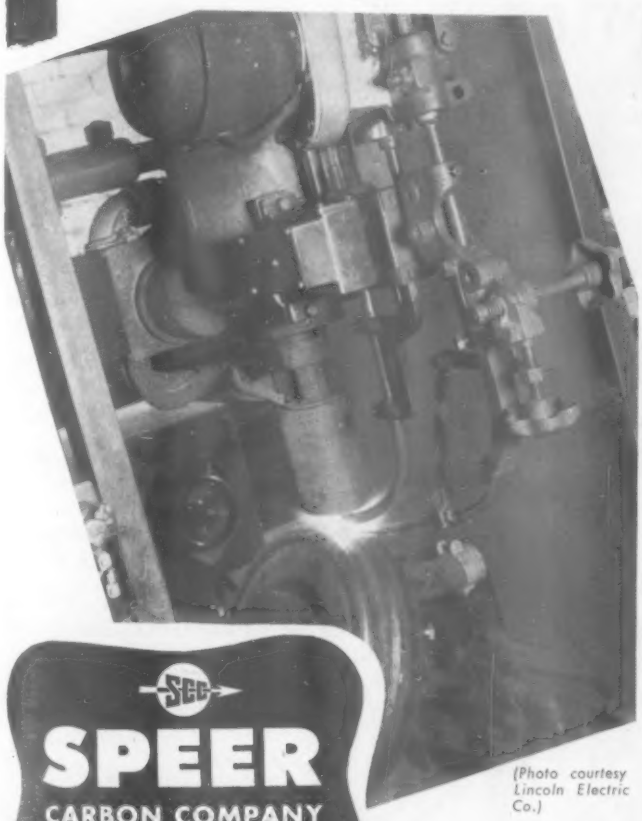
» «

John S. Richards, director of research of the American Steel & Wire Co., died suddenly at his home in Cleveland at the age of 49. He had been manager of the company's metallurgical division from April, 1937, to March, 1942, at which time he was appointed director of research.

13% MORE WELD with SPEER HOLD-ARK CARBON ELECTRODES

Because they develop a better point, SPEER HOLD-ARK electrodes provide 13% extra weld per inch of rod. SPEER points have a more acute burning angle, extending a much shorter distance back, thereby permitting all the rod to burn in useful work. No waste due to spindling.

22% stronger than the best rods previously available, HOLD-ARK rods can better withstand shock and abuse. Their quiet, smooth, intensely hot arcs are easy to work, pile on thicker welds with each passage. Specify SPEER HOLD-ARK electrodes and get far longer carbon life in automatic and hand welding.



(Photo courtesy Lincoln Electric Co.)

Automatic Carbon Arc Welding of Fluid Drive

SPEER
CARBON COMPANY
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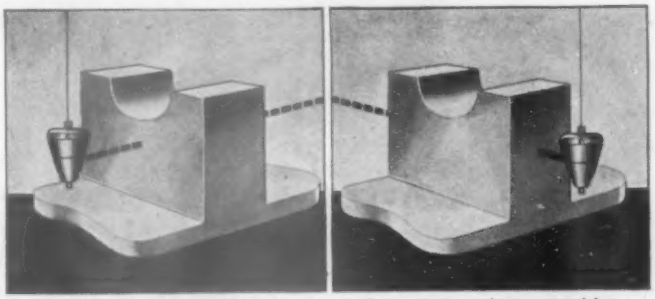
MILWAUKEE · NEW YORK · PITTSBURGH

CANADIAN RADIUM IN MODERN INDUSTRY

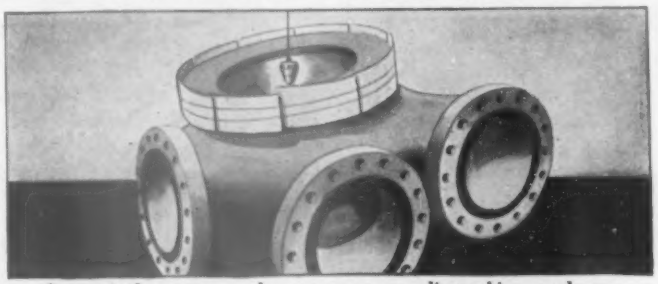
EASY WAY TO DETECT INTERNAL FLAWS

CANADIAN RADIUM SAVES

TIME, LABOR, MATERIALS
— INSURES SOUND PRODUCTION



Checking and cross-checking a metal section to insure positive detection of flaws, such as tight cracks, is easy with radium. Its Gamma-rays penetrate up to 10 inches of solid steel.



In a single exposure, clear, permanent radiographic records are made through critical areas on both sides of a ponderous casting, simply by suspending a radium capsule inside the aperture.

R-34

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Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Safe Welding Booklet

"Electric Welding" is the title of No. 105 of the more than 150 safe practices and health practices pamphlets published by **National Safety Council, Inc.,** 20 North Wacker Drive, Chicago. This 12-page, letterhead-size booklet covers both arc and resistance welding but not gas welding, which is discussed separately (see page 84, January, THE WELDING ENGINEER). Among the arc-welding topics included are protection against shock, harmful light rays, personal protective equipment (handshields, helmets, goggles, gloves, aprons, shoes etc.), health hazards and fire protection. Under resistance welding, there is discussed the hazards (lack of point-of-operation guards, flying hot metallic particles, possible electrical shock, etc.), personal protective equipment and the general precautions that should be taken.

» «

Weld Inspection Chart

An arc-welding inspection chart designed to help teach operators and inspectors to recognize welding faults at a glance has been published by **The Lincoln Electric Co.,** Cleveland. This 23 by 36 in. wall chart pictures nine specimens of fillet welds and seven of butt welds which were made under different conditions of the welding variables—current, speed and arc length. Accompanying each picture is a brief description of the appearance and characteristics of the particular weld shown with a statement of the conditions under which it was made.

» «

Power Factor Report

"Preventing and Correcting Low Power Factor" is the title of an eight-page, letterhead-size report (No. 146) published by **George S. May Business Foundation,** 111 South Dearborn St., Chicago 3. This study explains the meaning of power factor, discusses the causes and results of low power factor and introduces a power factor correction finder that includes all necessary computations on a circular disc.

» «

Standards List

The latest list of American Standards, published as of December 1, 1943, gives more than 600 standards, of which 64 have been approved or revised since the last price list was printed (April, 1943). The standards cover specifications for materials, methods of tests, dimensions, definitions of technical terms, procedures, etc. Thirty-nine standards pertain to ferrous materials and metallurgy and 18 standards to non-ferrous materials and metallurgy. The complete list is available free of charge from the **American Standards Association,** 29 West 39th St., New York City 18.

» «

Dated War Map

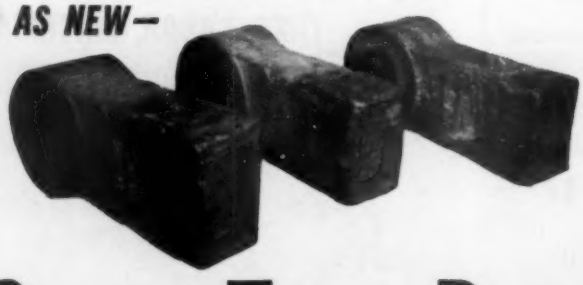
Both place and time of each important event of World War II are given on this new "Dated Events War Map" of the battle fronts of the entire world. Each important event from the start of the war is described and dated at the point where it occurred. Naval and air bases of all belligerents and the population and status of each country are also given. Map measures 38½ by 17 in. and is printed in several colors. **C. E. Phillips & Co.,** 2750 Poplar St., Detroit 8.

» «

Positioner Folder

Bulletin No. QW-116, four pages, 8½ by 11 in., illustrates various types of special welding positioners developed and built by the Quickwork Div. of **Whiting Corp.,** Harvey, Ill.

NOT GOOD AS NEW—



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YOU COULDN'T imagine tougher working conditions than the severe shock, impact and abrasion to which these foundry hammers are continually subjected. But, now that they are protected with the super-wear-resistance coating of Coast Metals Hard-Facing, they have what it takes to keep going! And last several times longer than uncoated hammers!

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CRITICAL TRANSPORTATION!

● REMEMBER WHEN a lot of folks traded in their cars for new ones *every year?* And the venerable age of two or three winters automatically assigned the ole family bus to the *jalopy* class? But not so today. America's *newest* cars are now observing their *third* birthday. Jalopies? No — *critical transportation*—with native ingenuity and a welding torch to keep 'em rolling to and from the war plants. (And the welding torch performs more economically if hooked to a Sight Feed Acetylene Generator—famous source of purer, hotter acetylene gas at savings up to 75%.)

THE *Sight Feed* GENERATOR COMPANY

Sales: Richmond, Ind. Factory: W. Alexandria, O.

Manganese Steel Data

The use of manganese steel for the construction industry is covered in detail in Bulletin 1143-CI published by the **American Manganese Steel Division** of American Brake Shoe Co., Chicago Heights, Ill. This 32-page, letterhead size booklet includes two pages of information on the salvage of worn parts by welding and hard-facing.

» «

Flux Chart

The new Krembs Fluxine Chart is said to provide a handy key for finding the best flux to use in connection with a host of welding, brazing or silver soldering jobs. The chart (which is in bulletin form) gives a list of all the common metals and alloys and recommends the most satisfactory flux to use on each metal or alloy for each of the different metal-joining processes. **Krembs and Co.**, 676 West Ohio St., Chicago 10.

» «

Goggle-Fitting Instructions

"Right on the Nose" is the title of a 20-page, 4 by 8½ in. booklet explaining the quickest, easiest methods of adjusting non-prescription industrial safety goggles so that workers can wear them in comfort. The booklet was prepared for safety directors, medical directors or other persons assigned to the job of fitting goggles, and its objective is to help prevent the eye accidents which are continually being caused by reason of workers refusing to wear improperly fitted, uncomfortable goggles. **American Optical Co.**, Southbridge, Mass.

» «

Book on Coated Abrasives

"Basic Information for the User and Buyer" is a down-to-earth discussion of coated abrasives, their component parts, their manufacture and their ultimate use. This 32-page, 5 by 7 in. booklet was originally printed for use by distributors' salesmen, but the many requests received for it from customers made it advisable to issue a new and larger edition. **Behr-Manning Corp.**, Troy, N. Y.

» «

Cast Iron Welding Data

Four different types of electrodes for welding cast iron are discussed in a new 12-page, letterhead-size booklet, "Four Ways to Salvage, Reclaim and Conserve Iron Castings by Arc Welding." This treatise opens with a frank discussion of the inherent difficulties which will be encountered in the arc welding of cast iron. It is pointed out that there is no single welding material or procedure which can be recommended as a universal practice but that the selection of an electrode and procedure for a specific application should be based on the requirements of the finished job. Microphotographs are reproduced to show the penetration and grain structure of the deposits made by the various electrodes described. **C. E. Phillips & Co.**, 2750 Poplar St., Detroit 8.

» «

Hard-Facing Catalog

Wall-Colmonoy Catalog No. 75 is an eight-page, letterhead-size booklet describing various types of hard-facing alloys and overlay metals. Under each alloy is given its general uses, hardness, corrosion-and-abrasion-resistant properties, machinability, and the welding method by which it is commonly applied. A full-page table lists the properties, composition, characteristics and typical uses of seven types of hard-facing welding rods and electrodes. **Wall-Colmonoy Corp.**, 720 Fisher Bldg., Detroit 2.

» «

"Angle Meter" Catalog

The eight pages of the 1944 catalog of the **Interstate Sales Co.**, 1123 Broadway, New York City 10, are devoted largely to a description of the "Wolfe Angle Meter," a contrivance for laying out any angle bend from 0 to 126 deg on either pipe or flat material. A number of sketches illustrate its many applications. Other measuring and calculating devices are also described, including the "Divizor" and "Circle-Meter" for reading the diameters and circumferences of circles and the "Mechanic's Protractor" for reading both outside and inside angles.

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Use This Dual Automatic Welding Fixture!

Automatic Welding-head Positioner — adaptable to your own holding fixture.

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

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Here is a 12-ton laboratory type hydraulic unit suitable for duplicating conditions of actual production (10,000 lbs. per square inch pressure) . . . Comes complete, with extrusion die-head . . . Ready to set on your floor, connect to your power line and start producing . . . Hydraulic and electrical controls at operator's fingertips . . . Welded steel construction . . . A smooth-working, efficient unit . . . Can be delivered in twelve weeks under proper priorities . . . Full information on request.

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Pipe-Thawing Data

Use of both d-c and a-c arc welders for thawing frozen pipes is discussed in a four-page, letterhead-size folder published by the **General Electric Co.**, Schenectady, N. Y. This publication (GEA-2059C) tells how extra profits can be secured by offering a pipe-thawing service to homeowners.

» «

Low-Temperature Welding

Latest data book on low-temperature welding to be published by Eutectic Welding Alloys Co. is a 36-page, letterhead-size booklet giving timely facts on the use of this process for fabrication, salvaging and general maintenance in various types of war industries and post-war applications. A double-page "Rod Selector" Chart gives weld properties and procedure information for the various types of rods and lists the rods recommended for different types of materials. **Eutectic Welding Alloys Co.**, 40 Worth St., New York City 13.

» «

Hard-Facing Book

"Hard-Facing with Haynes Stellite Products" is the sixth edition of a work giving much useful general information on hard-facing problems. In this 112-page, letterhead-size book, the applications of hard-facing are grouped by particular industries such as agriculture, automotive, brick, cement, coke and gas, excavating, iron and steel, lumber and paper, machinery, mining, oil and gas, power, etc. A four-page general index of machine parts provides a quick cross-reference; this index gives not only the page on which the part is discussed but also the recommended hard-facing electrodes. **Haynes Stellite Co.**, Carbide and Carbon Bldg., 30 East 42nd St., New York City 17.

» «

Lifting Jack Catalog

No. 202 catalog of the **Duff-Norton Mfg. Co.**, Pittsburgh 30, was issued for the specific purpose of describing those models of lifting jacks which the company is still permitted to manufacture under the War Production Board's recent Limitation Order L-322. The 32-page, letterhead-size booklet covers a wide variety of jack types and capacities.

» «

Tungsten Electrode Data

Callite Bulletin No. 154 is a four-page, letterhead-size folder which describes the application of tungsten electrodes to atomic-hydrogen, helium and argon arc welding. Data are given concerning the physical properties, dimensions and current range in amperes of the Callite tungsten electrodes available. **Callite Tungsten Corp.**, 540 Thirty-ninth St., Union City, N. J.

» «

Electronic Tube Fundamentals

The fundamentals and the various applications of electronic tubes are described in a 12-page, letterhead-size bulletin (GEA-4126) recently issued by the **General Electric Co.**, Schenectady, N. Y. This publication explains in simplified language the essential elements and operation of the eight basic industrial-type tubes: kenotron, pliotron, phanotron, ignitron, glow tube, phototube, thyratron and pentode. Practical applications of electronic controls, including the timing of resistance-welding currents, are also discussed.

» «

Electronic Drive Book

The "Thy-mo-trol" electronic drive (for providing and controlling adjustable-voltage power from a-c lines thus making possible the utilization of the inherent advantages of d-c motors) is described in a 40-page, letterhead-size bulletin, GEA-4025. This booklet explains the principles of the new drive and describes typical applications, including installations on grinders, turret lathes, drill presses, conveyors, form-and-thread milling machines, etc. Applications to machines for testing tachometers, magnetos, propeller governors and the tensile strengths of materials are also discussed. **General Electric Co.**, Schenectady, N. Y.

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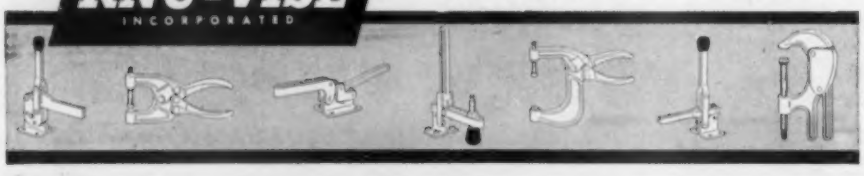

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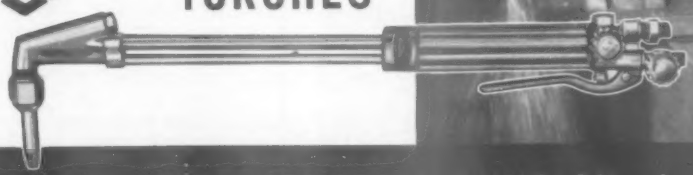

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Especially designed for roughing, peening, removing flux and excess metal resulting from welding operations.

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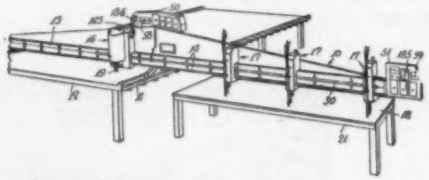
FROM THE PATENT OFFICE

Torch Cutting Machine

2,336,626. **Chester Mott,** Evanston, and **Alfred F. Chouinard,** Chicago, assigned to **National Cylinder Gas Co.,** Chicago. Filed May 28, 1941. Issued Dec. 14, 1943.



A cutting machine with a carriage supporting a cutting torch and a unit for driving the carriage along rails and the torch along the carriage. A slidable bar on the carriage connects the cutting torch and driving unit; the position of the unit along the bar is adjusted by a mechanism that includes a reversible motor. The direction of adjusting movement of the unit along the bar depends on the direction of movement of the motor.

» «

Torch Cutting Machine

2,336,596. **Alfred F. Chouinard,** Chicago, assigned to **National Cylinder Gas Co.,** Chicago. Filed Feb. 8, 1941. Issued Dec. 14, 1943.

A cutting machine with a carriage, tracing device and cutting torch. The latter is independently mounted on the carriage and is movable along it. A bar connects the tracing device and the torch independently of the carriage, and a releasable friction clutch connects the bar and torch. The torch moves along the bar against the frictional action of the clutch.

» «

Thermit Pellets

2,337,314. **John Howard Deppeler,** Weehawken, N. J., assigned to **Metal & Thermit Corp.,** New York City. Filed April 8, 1943. Issued Dec. 21, 1943.

A process for the manufacture of metals and alloys, in which a bath of molten metal having a temperature not substantially below 2,100 F is contacted with highly compressed thermit pellets. The thermit is comprised of at least one reducible metal oxide, aluminum as a reducing agent and up to 15% of a binder. The pellets have a minimum dimension not substantially exceeding ½ in. and a density corresponding to that produced by an applied pressure not substantially less than 100 psi; their heat conductivity is such that they react practically instantaneously upon contact with the metal bath. A substantial amount of preheat is required for the reduction of the oxide.

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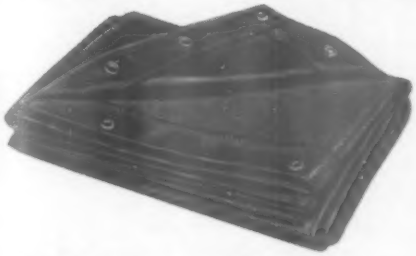

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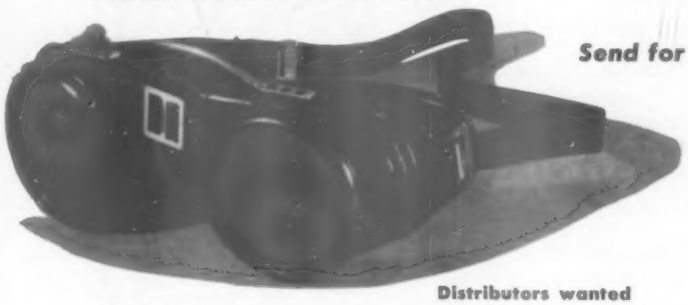

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Distributors wanted

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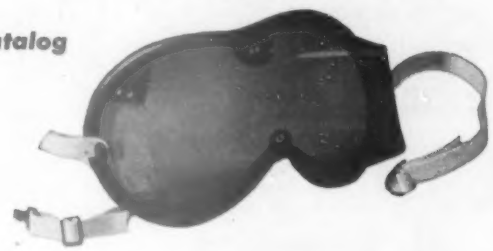

These Eye Shields are available in **light green tint;** also clear. Very light-weight.

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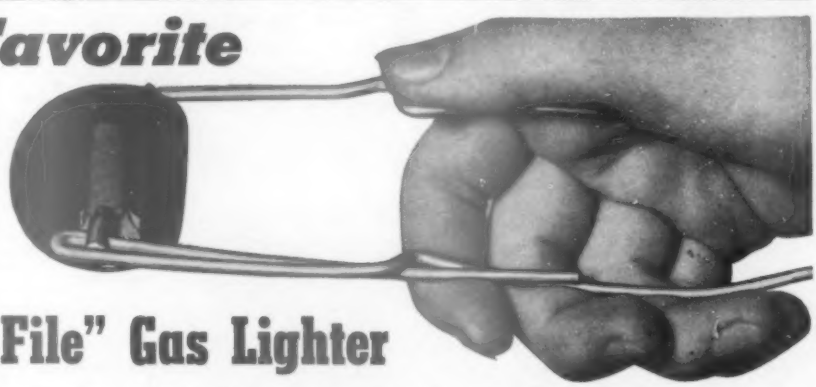

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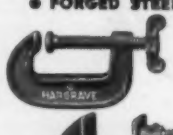

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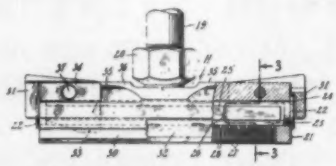
Resistance Welding Circuit

2,335,699. **Frank H. Roby,** Milwaukee, assigned to **Square D Co.,** Detroit. Filed April 21, 1941. Issued Nov. 30, 1943.

A method of operating upon a resistance welding work circuit. Closing of the initiating switch energizes an electric relay which sets in motion the driving motor of a motor-driven timing switch. When the timing switch has rotated to a predetermined position, a second relay is energized. Current is thus passed through the work circuit according to predetermined positions of the timing switch. The fluid pressure control which establishes the work circuit is energized when the initiating switch is closed and deenergized in another predetermined position of the timing switch. The driving motor of the switch is deenergized in still another predetermined position.

» «



Flame-Cleaning Tool

2,337,087. **Eibe W. Deck,** Plainfield, N. J., assigned to **Union Carbide and Carbon Corp.,** New York City. Filed July 18, 1940. Issued Dec. 21, 1943.

A torch head for producing a plurality of high-temperature heating flames. The head consists of an elongated metal body having a chamber that is divided by a baffle into upper and lower passages. A combustible mixture inlet leads to the upper portion of the chamber, while multiple outlets lead from the lower portion of the chamber. The two passages are sufficiently small to cause the combustible mixture to flow with a sufficient velocity to prevent preignition within the head.

» «

Flame-Cleaning Head

2,337,106. **Wilgot J. Jacobsson.** Plainfield, N. J., assigned to **Union Carbide and Carbon Corp.,** New York City. Filed July 24, 1940. Issued Dec. 21, 1943.

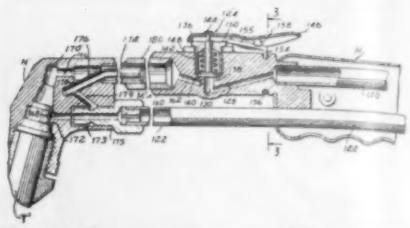
A torch head for producing a plurality of high-temperature heating flames. Head comprises an elongated metal body enclosing a chamber divided into upper and lower passages by a hollow baffle through which a cooling medium may be circulated. A combustible mixture of gases is supplied to the upper portion of the chamber, while the outlets lead from the lower portion.

» «

Torch Valve Assembly

2,335,987. **Lloyd W. Young,** Scotch Plains, N. J., assigned to **Union Carbide and Carbon Corp.** Filed Dec. 31, 1937. Issued Dec. 7, 1943.

This patent pertains to a flexible diaphragm valve adapted to be urged



into seating engagement with a portion of the gas passage in a welding torch in order to control the flow of gas therethrough. The valve is operated by means including a snap-operated lever, a spring clip substantially surrounding the valve body and forming a pivot for lever, and a knob coöperating with the clip to releasably lock the lever in a predetermined position.

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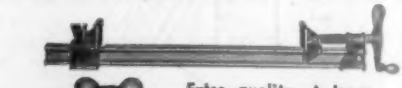

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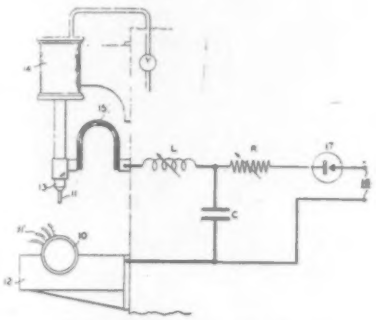
Hard-Facing Alloy and Rod

2,337,083. **Arthur T. Cape,** Santa Cruz, Calif., assigned to **Coast Metals, Inc.,** Canton, O. Filed July 14, 1942. Issued Dec. 21, 1943.

A ferrous alloy and a welding rod particularly adapted for hard-facing purposes. The alloy contains from about 0.50 to 1.25% carbon, from 2 to 7% chromium, from 2 to 7% nickel and from 5 to 10% molybdenum, the balance being substantially all iron.

The welding rod contains from about 0.30 to about 1.50% carbon, chromium and nickel in amounts of from 2 to 7% each and molybdenum in amounts of from 5 to 10%.

» «



Stud-Welding Method

2,337,294. **Joseph H. Cooper,** Warren, O., assigned to **The Taylor-Winfield Corp.,** Warren, O. Filed Feb. 18, 1942. Issued Dec. 21, 1943.

A method of fabricating a composite article having a metallic base from which project a plurality of closely spaced metallic studs. The studs are attached serially to the base by an electro-percussive welding method. They are held in a chuck and moved into engagement with base while an electrical potential exists between the base and studs. Each successive stud attached is bent over before the next stud is welded in order to avoid arcing between the chuck and/or the stud being attached and the stud or studs previously attached. Thus the studs can be positioned closely together.

» «

Hardness Tester

2,335,235. **Donald F. Clifton,** Milwaukee. Filed May 14, 1941. Issued Nov. 30, 1943.

An instrument for measuring hardness characteristics of a test specimen. Elements included are a supporting table, a specimen-carrying platform moving linearly along the table and a shaft journaled in and extending through the table for linear movement perpendicular to the plane of the platform. Shaft is adapted to extend through a longitudinal slot in the platform and has a cutting point at the end which extends through the slot. One end of a fulcrumed lever arm engages the end of the shaft opposite the cutting point, while an adjustable weight is mounted on the other side of the lever in order to bias shaft and its cutting point in a direction toward the specimen.

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MANGANESE BRONZES: General purpose rods, especially recommended for cast iron. TITAN MANGANESE BRONZE is doubly deoxidized, low fuming and flows at 1617° F. TITAN NAVAL BRONZE flows at 1620° F.

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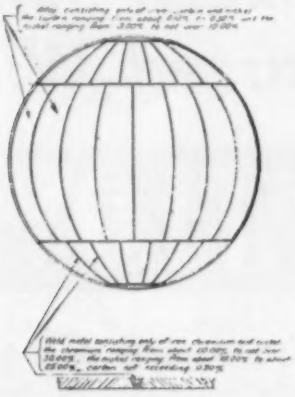
Welded Liquefied Gas Holder

2,337,049. **James O. Jackson,** Crafton, Pa., assigned to **Pittsburgh-Des Moines Co.** Filed Jan. 6, 1942. Issued Dec. 21, 1943.



A welded steel structure which will be subjected to load during normal use while at a temperature of below —100 F. Structure is characterized by possessing a minimum Charpy impact value of at least 10 ft-lb while at a temperature of as low as —260 F. The component structural parts are formed from nickel-alloy steel containing from 0.10 to 0.30% carbon and 3 to not over 10% nickel; these parts are united by nickel-chromium weld metal containing from 20 to 30% chromium, from 18 to 25% nickel and not over 0.30% carbon.

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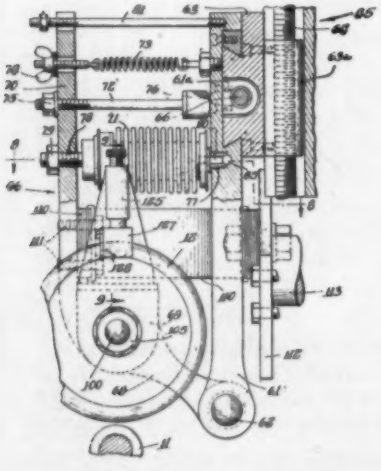


Seam Welder

2,337,037. **David Wendell Fentress,** Evanston, Ill., assigned to **Chicago Metal Hose Corp.,** Maywood, Ill. Filed March 10, 1941. Issued Dec. 21, 1943.

Seam-welding apparatus comprising an electrode wheel engageable with a work piece, means for passing welding current through the electrode while it is engaging the work piece and a fluid-pressure-operated expansible bellows for maintaining the electrode and work in contact during the welding operation. A spring opposes the action of the bellows, and a stop limits the movement of the spring.

Coated Aluminum Welding Rod

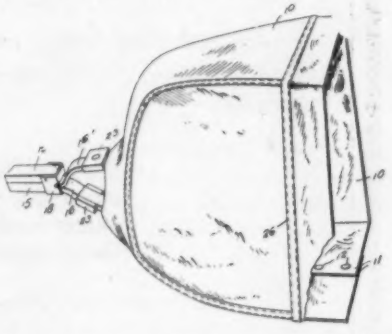
2,337,714. **Georg Haim** and **Eric John Rogers,** London, England, assigned to **Arc Manufacturing Co., Ltd.,** London. Filed Nov. 23, 1942. Issued Dec. 28, 1943.

A process for preparing a coated aluminum welding rod. The coating is formed of a powdered flux mixture consisting essentially of 30% sodium chloride, 30% potassium chloride, 15% lithium chloride and 25% cryolite. The powdered flux is melted and maintained molten at a temperature below the melting point of aluminum while the rods are dipped. After dipping, each rod is withdrawn at such a rate as to produce on it a coating of solidified flux of substantially uniform thickness.

» «

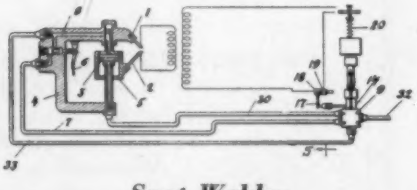
Electrode Holder Guard

2,337,767. **Dan Paul,** Port Arthur, Tex. Filed Sept. 26, 1942. Issued December 28, 1943.



A guard comprising a skeleton frame of wire formed in the general shape of a gauntlet with portions at its forward end to receive the handles of an electrode holder. A cover of flexible heat-resisting material is secured at the forward end of the frame by flaps having fastening devices. These flaps are arranged to embrace portions of the holder and to pivotally secure it in the guard.

» «



Spot Welder

2,337,022. **Edward G. Beiderman,** Detroit, assigned to **General Motors Corp.,** Detroit. Filed Jan. 13, 1936. Issued Dec. 21, 1943.

This spot-welding patent pertains to the combination of means for supplying fluid pressure, a movable member functioning in each operation of the welder, means for moving the aforementioned member by the aid of the fluid pressure, means for supplying electrical energy. The latter includes a contactor or timer having a movable part and a control for the fluid pressure which operates the movable element of the contactor.

Spot Welder Control

2,338,540. **Frank H. Roby,** Milwaukee, assigned to **Square D Co.,** Detroit. Filed June 12, 1941. Issued Jan. 4, 1943.

A welder control system in which unidirectional stored electrical energy is discharged between the electrodes. Elements are the energy-storing means, a d-c source for supplying energy, multiple contactors for connecting the current source to the energy-storing means, and a means for opening these individually operating contactors in timed sequence to open the circuit at a plurality of points.

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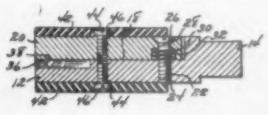

Electrode Holder

2,335,810. **Alfred R. Stalkup,** Marshfield, Ore. Filed Nov. 30, 1942. Issued Nov. 30, 1943.

The first and second sections of this electrode holder have meeting faces and are pivotally connected for relative movement in a plane corresponding to the plane of the meeting faces. The face of one section has an electrode-engaging formation for clamping the electrode against the meeting face of the other section. The two sections are restrained from accidental pivotal movement.

» «

Seam-Welder Circuit

2,337,842. **Joseph Slepian,** Pittsburgh, assigned to **Westinghouse Electric** and **Mfg. Co.,** East Pittsburgh. Filed Feb. 23, 1939. Issued Dec. 28, 1943.

For use in supplying current from an a-c source to a load, this circuit includes a pair of ignitrons, each having a cathode and an ignition electrode. The ignitrons are interposed between the source and the load in such manner as to conduct alternate half cycles of current. Multiple rectifiers are interposed between each ignition electrode and its corresponding cathode in such manner as to conduct current from the ignition electrode to the cathode. The multiple rectifiers are conductively connected for a predetermined interval of time.

» «

Automatic Spot Welder

2,337,019. **John Abplanalp,** Detroit, assigned to **General Motors Corp.,** Detroit. Filed Feb. 24, 1936. Issued Dec. 21, 1943.

This patent covers the combination of primary and secondary circuits in a spot welder, a pair of electrodes, power means for opening and closing them, an automatic timer, a source of fluid pressure, and means controlled by the fluid pressure to cause the electrode-closing means to periodically repeat the cycle of operations as long as the fluid pressure is kept on.